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Safety Standards for Explosives and Blasting; Final Rule

DEPARTMENT OF LABOR

Mine Safety and Health Administration

30 CFR Part 75

Safety Standards For Explosives And Blasting

AGENCY: Mine Safety and Health Administration, Labor.

ACTION: Final rule.

SUMMARY: This final rule revises the Mine Safety and Health Administration's (MSHA) existing safety standards for explosives and blasting in underground coal mines. The revisions update existing provisions consistent with current technology, eliminate duplicative and unnecessary standards, reorganize the existing standards and provide alternative methods of compliance where possible.

EFFECTIVE DATE: The final rule is effective January 17, 1989.

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SUPPLEMENTARY INFORMATION:

I. Background

The final rule revises the Mine Safety and Health Administration's existing safety standards for explosives and blasting in underground coal mines. These revisions are promulgated under section 101 of the Federal Mine Safety and Health Act of 1977 (Mine Act).

On May 8, 1984, MSHA published a notice in the **Federal Register** which announced the availability of its preproposal draft of explosive standards and scheduled public conferences to discuss it (49 FR 19601). Public conferences were held June 12, 1984, in Lexington, Kentucky, and June 14, 1984, in Pittsburgh, Pennsylvania. These conferences were well attended and MSHA received written comments from all segments of the coal mining community.

On May 9, 1986, MSHA published a proposed rule in the **Federal Register** (51 FR 17284). The proposal addressed the comments received regarding the preproposal draft. MSHA published a notice of public hearings in the **Federal Register** on October 21, 1986 (51 FR 37376). Hearings were held on November 18, 1986, in Pittsburgh, Pennsylvania, and November 20, 1986, in Lexington, Kentucky.

MSHA published a **Federal Register** notice (58 FR 9670) scheduling another hearing to receive additional testimony from interested parties concerning safety considerations when instantaneous and short-delay electric detonators are used in the same circuit. This hearing was held in Bruceton, Pennsylvania on April 22, 1987. The record remained open until May 15, 1987, to allow for the submission of post-hearing written comments and data on this issue. The record closed on December 19, 1986 for all other issues.

The Agency's final rule addresses the major comments received and is consistent with the goals of Executive Order 12291, the Regulatory Flexibility Act, the Paperwork Reduction Act and the Mine Act.

II. Discussion of the Final Rule

A. General Discussion

The use of explosives in underground coal mines presents a potentially serious risk of injury and death to miners. From 1978 through 1987 there were 41 fatalities resulting from the improper use of explosives. Additionally, during this period there were 312 nonfatal injuries in coal mines resulting from the improper use of explosives. Prevention of accidents involving explosives depends to a large extent on the knowledge and experience of persons in the mine responsible for using explosives, and adherence to the standards which guide mine operators and miners in the safe conduct of blasting operations.

The final rule addresses the need for knowledgeable and experienced personnel to perform blasting functions by requiring only "qualified persons" or persons working in the presence of and under the direction of a qualified person to use explosives underground. The final rule also updates MSHA's existing standards for explosives consistent with modern blasting practices and products. The final rule supplements existing standards where they currently do not address important aspects of blasting and deletes obsolete provisions.

Prevention of accidents with explosives is also dependent on the use of components especially designed to operate safely in an underground environment containing coal dust and methane gas. The final rule continues to require that explosives and blasting units used in underground coal mines be approved by MSHA. The regulations governing MSHA approval of explosives and sheathed explosive units are being published, in a separate rulemaking, simultaneously with this final rule. The Agency is also developing revisions to the approval requirements for blasting units. These revisions, which have been proposed as a subpart to 30 CFR Part 7, Product Testing by Applicant or Third Party, were made available for public comment in the **Federal Register** on June 22, 1988 (53 FR 23506). In addition, MSHA will seek to include in its regulatory program an approval schedule for detonators used in underground coal mines. As part of that rulemaking, changes would be made in this final rule to require the use of such approved detonators.

B. Section-by-Section Discussion

Section 75.1300 Definitions.

The practice of sequentially lettering general definitions in existing subparts, which was carried forward in the proposed rule, has been eliminated in this final rule. The former method was confusing to many commenters who questioned why the Subpart N revision of definitions began at letter "r". The final rule now contains definitions of terms specifically related to Subpart N arranged in alphabetical order.

Many commenters stated that the term "permissible", which was excluded in the proposed rule, has and continues to have widespread use and should be retained in the final rule. As a result, the final rule includes two definitions from the preproposal, "permissible blasting unit" and "permissible explosive."

The following definitions apply to Subpart N:

Approval. This term describes a written document issued by MSHA which states that an explosive or explosive unit has met the requirements of Part 15 and which authorizes an approval marking identifying the explosive or explosive unit as approved as permissible. This definition has been added to make Part 75, Subpart N consistent with Part 15.

Battery starting. This definition identifies a specific exclusion to the prohibition of firing shots outside a borehole and applies only to anthracite mines. A commenter objected to the use of unconfined shots in battery starting preferring to initiate the flow of coal down a breast or chute by other means, thereby reducing exposure of miners to unnecessary hazards. However, this procedure has been performed in anthracite mines for many years as long as methane was reduced to less than 1 percent. Because anthracite dust is not explosive, it does not present the same hazard as bituminous coal dust and the Agency has therefore retained the definition.

Blasting off the solid. This definition provides an explanation of a blasting technique which occurs without the provision of a kerf or second free face. The final rule is extended to include rock as well as coal blasting in response

to commenters who stated that it is not uncommon to encounter a rock fault across the full working face. While some commenters recommended prohibiting blasting off the solid stating that the practice is outdated and an unsafe method of mining, the Agency defines and regulates this practice under this final rule.

Instantaneous detonator. This definition describes a type of electric detonator that is commercially available for use in underground coal mines and which also has the performance characteristics for use with a sheathed explosive unit.

Laminated partition. This definition specifies the construction of the partition required to separate detonators from explosives when transported or stored. The definition remains unchanged from the proposed rule.

Opener hole. This definition describes the first borehole or holes fired in a ground when blasting off the solid to create an additional free face. This definition is essentially unchanged from the proposed rule.

Permissible blasting unit. This definition specifies a device which has been approved by MSHA for firing electric detonators. MSHA is in the process of revising the approval requirements for blasting units. The term "approved" that was used in the proposed Part 75, Subpart N definition is changed to "permissible" in response to comments. The proposed rule used the term "approved" instead of "permissible" to describe the explosive and blasting equipment required to be used by these provisions. The purpose of this was to standardize MSHA terminology used to describe mining products evaluated for safety by the Agency. Commenters objected, however, stating that this would result in confusion. In support of this, they noted that the term "permissible" has a long history of use in the explosives industry and that it also appears in State mining regulations. MSHA agrees that the term "permissible" is pervasively used in the industry worldwide to describe MSHA-approved explosives and blasting units. Upon reconsideration, MSHA retains the term "permissible blasting unit" in the final rule.

Permissible explosive. This definition specifies an explosive substance approved by MSHA for use in underground coal mines. As indicated above, the term "permissible" was used in the preproposal, but not retained in the proposal. Commenters urged that the term "permissible" be used instead of the term "approved." The final rule retains the term "permissible explosive."

Round. This definition describes a group of boreholes which are fired or intended to be fired in a continuous sequence by a single application of the firing current. One commenter suggested that the term "shots" in the proposed definition be changed to "holes" because this term is accepted and familiar in the industry. However, in the final rule, the term "shots" is changed to "boreholes." This term is more specific and is in keeping with the Agency's intent that regulations be as unambiguous as possible.

Sheathed explosive unit. This definition, as does the proposed definition, describes the unit as "a permissible explosive covered by a sheath of flame-inhibiting material encased in a sealed covering." Commenters stated that this terminology was too specific and would not provide for new technology. However, provisions are added to § 75.1315 to allow for the introduction of new technology. Accordingly, the definition is retained in the final rule to distinguish the units from other types of explosives.

Short-delay electric detonator. This definition specifies the range of delay periods for short-delay detonators that are commercially available for use in underground coal mines.

One commenter recommended that delay period numbers be included in the definition. However, delay period numbers corresponding to a given delay time may vary from manufacturer to manufacturer and thus not be uniform throughout the industry. Therefore, the Agency has not included delay period numbers in the definition.

Another commenter stated that the extension of the delay period beyond 500 milliseconds is not supported by established or promulgated regulations. However, research conducted by the Bureau of Mines, in conjunction with MSHA, has provided evidence that this time period can be extended to 1,000 milliseconds without increasing the risk of a methane or coal dust explosion. Accordingly, the definition is unchanged from the proposal. Comments concerning approved detonators are further discussed under § 75.1310(e).

Section 75.1301 Qualified person.

This standard revises the existing provision of 30 CFR Part 15 requiring explosives to be fired by "certified shot firers" and sets forth requirements for becoming qualified to perform this work.

MSHA statistics indicate that the persons most frequently injured in accidents with explosives are those firing the explosives. A frequent contributing factor has been the failure of these persons to follow safe blasting practices.

To address this risk to miner safety, the proposal included alternative qualification requirements for persons using explosives. Under the proposal, persons could have been qualified to use explosives if they were certified or qualified to do so by the State in which the mine was located, or if they had at least 1 year of underground coal mining experience and have demonstrated to an authorized representative of the Secretary the ability to properly use permissible explosives.

The final rule provides two alternatives for achieving qualification under this subpart. First, a person is a "qualified person" when the individual is certified or qualified to use explosives by the State in which the mine is located, provided that the State requires a demonstration of ability to safely use permissible explosives in accordance with Subpart N. This approach continues to recognize State qualification and certification programs for shot firers. However, under the final rule these programs will only be recognized if a demonstration of ability is included in the State program. This change from the proposal and existing standards recognizes evaluation of the individual's skill to safely use explosives to be the objective of the qualification requirement in the final rule.

Second, in States that do not certify or qualify persons to use explosives, a person is a "qualified person" if the individual has at least 1 year experience working underground on a coal-producing section of a mine where explosives are used and demonstrates to an authorized representative of the Secretary the ability to safely use explosives. Upon successful demonstration of this ability, MSHA's authorized representative will make application through the Qualification and Certification Unit in Denver, Colorado and a document indicating Federal qualification will be issued to the applicant. This aspect of the final rule provides for Federal qualification of persons to use explosives in underground coal mines. It addresses the need for a qualification program where none is available from the State in which the mine is located. The requirement is supported by MSHA accident data which shows that failure of the blaster to follow safe blasting practices or regulations was a contributing factor in over 80% of the fatal blasting accidents in underground coal mines from 1980 through 1986. In

addition, a Bureau of Mines evaluation of coal mine blasting accidents between 1978 and 1981 shows that the blaster was the person injured in 65% of the accidents.

The 1-year experience requirement was included in the proposal. However, the final rule specifies that such experience must be acquired while working on a coal-producing section where explosives are used. This change reflects the need for relevant experience that can be expected to provide the prospective qualified person with basic knowledge about the underground coal mining environment where explosives are used and the safety considerations uniquely involved in this work. To protect the safety of himself and others, the blaster must be capable of recognizing hazards associated with methane and roof and rib conditions in the working place. Additionally, the blaster must know the potential dangers from equipment and other mining activities in the immediate face area. He must also be experienced in face area development and mining techniques to ensure the safety of all section personnel during blasting.

One commenter expressed the opinion that State shot firer certification programs are inadequate and noted that training courses and written tests are required in other major mining countries. Other commenters stated that certain State programs such as those in Colorado and Virginia were effective and therefore should not be duplicated by the Federal Government. No comments from any State mining agencies were received on this issue. MSHA recognizes that State requirements for qualification or certification of persons to use explosives are not uniform. These programs, however, can provide appropriate systems for qualifying persons if certain necessary elements are met. The final rule, therefore, continues to recognize them, provided that a demonstration of ability to safely use permissible explosives in accordance with this subpart is included in the State program. The demonstration of ability requirement will provide a means of ensuring that each person is competent to use such explosives.

MSHA is aware that there are States which do not currently require this demonstration of ability in their qualification programs and, therefore, need time to address this issue. For this reason, paragraph (b) provides that persons qualified or certified by a State to use permissible explosives underground prior to May 17, 1989, that is, six months after publication, are considered qualified under § 75.1301 even though the State program did not contain a demonstration of ability requirement. During this six-month period, those States with programs which do not meet the requirements of this rule can take the necessary steps for a demonstration of ability provision in their programs. After the six months have elapsed, however, State programs without this provision will not be recognized by MSHA and persons qualified or certified under such programs will not be considered "qualified persons" for purpose of this rule.

For purposes of Federal qualification, other commenters suggested deletion of the coal mining experience requirement and retaining only a demonstration of ability requirement. These commenters indicated that if persons can demonstrate their ability, then experience is unnecessary. The commenters went on to note that, in the western United States, miners with extensive underground noncoal mining experience could be precluded from being qualified persons and that, as a result, some western coal mine operators might encounter difficulty finding miners with the required experience.

The conditions and hazards inherent in underground coal mining where explosives are used are different than most noncoal mines. The presence of methane gas and coal dust in the mining atmosphere presents hazards from ignitions and mine explosions not encountered in most other types of mines where explosives are used. For these reasons, the proposed coal mining experience requirement is retained in the final rule.

A commenter also recommended that MSHA continue to recognize State programs for qualifying persons to use explosives in underground coal mines, but not establish a new Federal requirement. This approach, however, was not adopted since it would not address the qualification of persons to work in mines in States with no qualification or certification program.

Section 75.1310 Explosives and blasting equipment.

This section of the final rule is derived from existing §§ 15.19(d), 75.1300 and 75.1303 except paragraph (d) which is new, and prescribes the types of explosives and blasting equipment that are permitted in underground coal mines. In addition, the section prohibits certain types of blasting materials from being taken or used in underground coal mines.

Paragraph (a) allows only permissible explosives, approved sheathed explosives units and permissible blasting units to be taken into or used in the underground areas of coal mines because of the potential explosive atmosphere. The final rule differs from the proposed rule in several respects. The proposal specified that explosives taken underground be approved under 30 CFR Part 15, Requirements for Approval of Explosives and Sheathed Explosive Units. It did not expressly recognize sheathed explosive units nor specify that only approved blasting units be taken underground. For clarity, the final rule identifies approved sheathed explosive units, which will be evaluated for use in mines by MSHA under revised Part 15, as being permitted in underground coal mines. In addition, it specifies that only permissible blasting units are to be taken or used underground.

Paragraph (b) lists those blasting items which are not permitted to be taken into or used in underground areas. These are black blasting powder, aluminum or aluminum-alloy-cased detonators with aluminum leg wires and safety fuses. Black blasting powder and safety fuses involve recognized fire and explosion hazards. Black blasting powder is highly deflagrating and does not have the flame-inhibiting characteristics required for approved explosives. The final rule identifies black blasting powder as a prohibited explosive in underground coal mines. This was not included in the proposal because only approved explosives, which do not include black blasting powder, were to be permitted underground. For clarity, however, the final rule retains the existing prohibition against the use of black blasting powder. A safety fuse, when ignited, produces a jet of flame that will ignite methane or float coal dust. Aluminum also presents a safety hazard because of its high incendivity. A coating of aluminum oxide can also form on the blasting wires and cause an increase in the electric contact resistance which can be the source of a misfire in a blasting circuit. Because of the mechanical properties of aluminum wire, splices can also loosen and reduce the contact between conductors.

Explosives, sheathed explosive units and blasting units must meet certain design and performance requirements to be approved for use in the potentially explosive atmosphere of underground coal mines. The materials prohibited by paragraph (b) do not meet these safety requirements and are known to present

a hazard if used in underground coal mines.

Some commenters requested that the proposed prohibition of nonelectric initiating systems be removed. While the final rule does not retain the proposed prohibition against nonelectric initiating devices, the definitions of instantaneous and short-delay detonators address only electric initiation systems. Commenters presented information which shows that new developments in explosive initiating systems indicate that alternate systems safe for use in underground coal mines may be developed in the foreseeable future. Presently MSHA has no criteria with which to evaluate nonelectric initiating systems. Until such time as standards are developed, the present petition for modification procedures are available to the mining industry. This process would require a case-by-case evaluation of nonelectric initiating systems to determine whether they perform as safely as the present performance of electric initiating devices.

Paragraph (c) requires that explosives be fired only with a permissible blasting unit used in a manner consistent with the blasting unit approval. This provision of the final rule replaces the proposed provision that explosives be fired only with an approved blasting unit that has sufficient capacity and is appropriate for the blasting operation.

MSHA recognizes that firing rounds containing a large number of boreholes is necessary under certain circumstances, such as when large amounts of rock need to be blasted. To address these conditions, blasting units designed to fire more than 20 boreholes, sometimes called large-capacity blasting units, have been tested and evaluated by the Agency under interim criteria and specifications and have been permitted to be used. The Agency's existing approval regulations for blasting units, 30 CFR Part 25, do not include specifications for the approval of such units. However, through the separate rulemaking of 30 CFR Part 7, Subpart D Blasting Units, MSHA has proposed new approval specifications that would recognize blasting units with the capacity to fire more than 20 boreholes in a round. Until these new approval regulations for blasting units are completed, blasting units evaluated under interim criteria by MSHA for safe use in underground coal mine atmospheres are considered to be approved for purposes of this regulation. Paragraph (c), therefore, requires that explosives be fired only with a permissible blasting unit used in a manner consistent with its approval.

Those blasting units that are approved by MSHA to fire only short-delay electric detonators will still continue to be permissible under this final rule. The Agency intends to allow these units to be used when firing instantaneous and short-delay detonators up to 1,000 milliseconds in bituminous mines, and also long period delay detonators in anthracite mines since there is no safety hazard apparent in using blasting units with either of these detonators. Research conducted by the Bureau of Mines in developing criteria for sheathed units and evaluating delay periods for detonators has demonstrated that permissible blasting units approved under Part 25 can be used safely with instantaneous, short- and long-delay detonators.

The primary purpose of using approved blasting units is to minimize the risk of igniting methane gas released by blasting or igniting coal dust placed into suspension by the forces created by the detonation of explosives. While this hazard is greater in the face area and in return air courses, it is also present in other areas of the mine when explosives are fired. As noted in the proposal, in 1970 a coal dust explosion occurred in an area outby the face and 38 miners were killed. While this accident may not have been caused by the failure to use an approved blasting unit, it does demonstrate that the potential exists for an ignition of coal dust or methane in areas of the mine other than inby the last open crosscut or in return air courses. For this reason, the final rule retains the principle of the existing standards that only blasting units approved as permissible are permitted in underground coal mines.

A commenter questioned the proposed requirement that the blasting unit used be "appropriate for the blasting operation". The purpose of this provision was to require that the capacity and function of the blasting unit be matched with the blasting to be performed. This purpose is addressed by the final rule which requires that a permissible blasting unit be "used in a manner consistent with its approval". Thus, if a blasting unit is approved to initiate up to 20 boreholes per round, it must not be used to initiate more than 20 boreholes in a round.

Paragraph (d) prohibits the use of permissible explosives and sheathed explosive units underground when they are below the minimum product firing temperature specified by the approval. The minimum product firing temperature for permissible explosives and sheathed explosive units are part of the approval issued for such explosives and sheathed units under Part 15. As explained in the proposal, the product temperature at which an explosive or sheathed unit is used directly affects its safe performance. Additional discussion of this issue can be found in the new explosives approval regulations.

Several commenters noted that the minimum product firing temperatures for approved explosives are not presently available. Previous MSHA regulations for the approval of explosives did not address a minimum product firing temperature. In Part 15, the final rule for the approval of explosives and sheathed explosive units requires the manufacturer to designate and display the minimum product firing temperature on the approval label. Under this final rule, explosives and sheathed units must not be fired when the product is below the temperature appearing on the approval label. MSHA will continue to allow the use of previously approved explosives recommending that they be fired in accordance with the manufacturer's recommended product temperature.

Paragraph (e) requires that electric detonators be compatible with the blasting unit and have sufficient strength to initiate the explosive being used. When operated, permissible blasting units provide a short burst of electric current within certain specifications. Factors that influence the performance of these units in conjunction with permissible explosives include the resistance created by the detonators to be fired and the energy necessary to initiate them. For example, detonators requiring more than 2 amperes to reliably initiate them may result in misfires when used with permissible blasting units. Likewise, some imported detonators of less than No. 8 strength may not reliably fire certain types of permissible explosives. MSHA is aware of detonators, introduced into the U.S. market and advertised as suitable for use in gassy mines, which require an initiating current exceeding the tested capacity of blasting units approved under 30 CFR Part 25. Further, Bureau of Mines tests of other imported detonators entering the U.S. market show reduced minimum no-fire currents. Uncontrolled minimum no-fire currents could lead to detonation of explosives during circuit testing, or greater sensitivity to stray electrical currents. These are examples of detonators which would be incompatible with the blasting unit and therefore not allowed under this provision.

Under the preproposal draft, the issue of detonator compatibility was to be primarily addressed by new MSHA approval regulations for detonators. The proposal did not retain this approach, except that it would have required blasting units to "have sufficient capacity and be appropriate for the blasting operation". Since the proposed rule was published, MSHA has become aware of new detonators on the market which may not have the same characteristics as those previously available. Therefore, MSHA will seek to include an approval schedule for detonators used in underground coal mines in its regulatory program.

Section 75.1311 Transporting explosives and detonators.

This standard is derived from existing §§ 75.1301, 75.1304, 75.1305 and 75.1403–7 except § 75.1311(b)(2). This section specifies the requirements for transporting explosives and detonators underground. The hazards addressed by these standards are damage to explosives and detonators and accidental detonations. The final rule maintains the approach used in the proposal by specifying requirements for particular methods of transportation.

The final rule also adopts the suggestions of a commenter who recommended that the new standards should distinguish between track-mounted and other types of vehicles. The final rule distinguishes requirements for cars or vehicles and trolley locomotives based on the unique hazards which are presented by each mode of transportation. The final rule separately addresses the transportation of explosives and detonators by hand.

Paragraph (a) sets forth general requirements for transporting explosives and detonators underground, regardless of the transportation method. As in the proposal, the final rule requires that explosives and detonators be enclosed in separate, substantially constructed containers made of nonconductive material, with no metal or other conductive material exposed inside. It further clarifies that both Class A and Class C detonators in quantities greater than 1,000 be maintained in the original containers as shipped from the manufacturer to gain additional protection against accidental initiation. This is consistent with Department of Transportation (DOT) requirements for transporting explosives and detonators unless they are transported in separate vehicles. This provision reduces the risk of damage or spillage. Transporting explosives and detonators in separate containers segregates the initiating devices from the explosives, thus providing protection against accidental detonation of the explosives by the detonators. Substantially constructed, nonconductive containers protect explosives and detonators from electric current and damage or spillage during transportation. Typically, original containers for explosives are heavy grade cardboard with a water-repellant finish. When closed and in good condition, these containers adequately protect the contents. Likewise, the original packaging for detonators is nonconductive and holds the product in a stable, protected fashion suitable for transportation underground.

Paragraph (a) also requires that each container of explosives and detonators be indelibly marked with a readily visible warning identifying the contents. This final rule differs from the proposal which required only that the container be marked with a warning identifying the contents as explosive.

One commenter noted that the proposal might have allowed a person to print a warning with chalk and suggested that reflective lettering at least 6-inches high be required. The final rule provides that the warning must be "readily visible". This means that the warning must be easily seen by those people who work in the vicinity of the containers so as to alert them to the presence and contents of the containers. With this approach, the final rule permits the use of any effective method that informs approaching miners of the presence of explosives and detonators. In the final rule "indelibly" marked is added in response to this comment. "Indelibly marked" does not allow the use of chalk or any writing material which could be smeared, erased, or susceptible to change from the mine environment.

Paragraph (b) of the final rule applies when explosives and detonators are transported by any type of cars or vehicles. The cars or vehicles must be marked with warnings identifying the contents as explosive. The warning must be visible for miners approaching from any direction and be written in indelible letters. This warning can be in the form of removable signs. The final rule remains substantially the same as the proposal. The term "vehicle" is added to the final rule to clarify that these standards apply to any type of explosives and transportation equipment used underground. Because a car or vehicle can change direction or be approached from various sides and directions, the final rule essentially includes the preproposal provision in specifying that the warning be readily visible to miners approaching from any direction.

Several commenters suggested that the final rule include a new requirement that containers carrying explosives and detonators be situated in vehicles and cars so that they do not extend beyond the profile of the vehicle. While such a provision would limit the possibilities of damage and spillage if a container were to strike the roof or a rib, MSHA has concluded that such a requirement is unnecessary. The Agency's evaluation of explosive-related transportation accidents in underground coal mines did not indicate that any of these accidents were caused by the containers of explosives or detonators extending beyond the profile of the vehicle.

Paragraph (b) also addresses requirements for transporting detonators with explosives. It requires that explosives and detonators be transported in separate cars or vehicles. As an alternative, explosives and detonators may be transported in the same car or vehicle, provided that both Class A and Class C detonators in quantities greater than 1,000 are kept in the original containers as shipped from the manufacturer and separated from explosives by a hardwood partition of at least 4 inches thick, a laminated partition or equivalent. Additional protection must be provided when transporting these types and quantities of detonators with explosives. The experience of the Institute of Makers of Explosives (IME) has also shown that all Class A and Class C electric detonators may be shipped with prescribed packaging requirements and quantities in an IME 22 container. This container provides protection which is consistent with the hardwood or laminated partition prescribed in this rule. The IME publication entitled "Guide for the Use of IME 22 Container", April, 1988, provides information related to packaging and container shipment of detonators. Both Class A and Class C detonators may be transported in quantities of no more than 1,000 in the same vehicle with explosives if separated by 4 inches of hardwood, a laminated partition or equivalent. The principal purpose behind separating explosives and detonators during transportation is to minimize the danger of detonating the explosives in the event the detonators are accidentally initiated. The final rule further clarifies explosives transportation requirements in the proposal by requiring additional protection when certain detonators are transported with explosives. This final rule provision is consistent with IME guidelines and DOT regulations.

In response to several comments to the preproposal, the definition of "laminated partition" was revised in the proposed rule to specify minimum nominal dimensions for a laminated barrier rather than exact dimensions. The definition was derived from the Institute of Makers of Explosives, Pamphlet Number 22, January 1, 1985. The final definition is the same as the proposal.

Paragraph (b)(3) prohibits persons, other than those necessary to operate the equipment or to accompany the explosives and detonators, from being transported with the explosives and detonators. This provision is the same as the proposal and provides for a minimum number of miners to be exposed to a potentially hazardous situation.

Several commenters recommended that the final rule distinguish between track-mounted vehicles used for transportation of explosives and detonators and other types of vehicles used for this purpose. In response to these comments, and recognizing that certain track-mounted vehicles carrying explosives and detonators can involve hazards such as sparks from an arcing trolley wire which are not present with other types of vehicles, the use of trolley locomotives is separately addressed in paragraph (b)(4).

The final rule revises and makes mandatory the existing safeguard criterion in § 75.1403–7(i). It requires that trips carrying explosives and detonators be separated by at least a 5-minute interval from mantrips. Although not included in the proposed rule, a similar provision requiring a 5-minute interval was included in the preproposal draft. One commenter objected that the provision was not in the proposed rule. Based on the Agency's experience with the existing criterion, the 5-minute interval is an effective safety measure. This precaution reduces the chance of any collision with other track haulage equipment when explosives or detonators are being transported. Should a collision occur causing the detonation of transported explosives, the entire mine is in jeopardy of a propagating coal dust explosion. A review of MSHA accident data shows a high frequency of track haulage accidents underground. This information coupled with the hazards of transporting explosives and detonators, has caused MSHA, upon reconsideration, to adopt the 5-minute interval but limits the application to mantrips rather than all trips as specified in the preproposal. No commenters on the preproposal opposed its inclusion. The final rule deletes the existing criteria provision contained in § 75.1403–7(i) and makes the 5-minute interval mandatory for all mantrips.

The final rule also requires that when trolley locomotives are used, the cars containing explosives and detonators must be separated from the locomotive by at least one car that is either empty or that only contains noncombustible materials. This standard was included in the preproposal, but not in the proposal draft. It addresses the danger of an accident or a sudden stop during which the explosives or detonators could, unless adequately separated from the locomotive, come into contact with the heat or electricity generated by the locomotive, possibly resulting in an explosion.

Paragraph (c) sets forth requirements for transporting explosives and detonators on conveyor belts. These standards require explosives and detonators to be kept separated to avoid an accident with one from involving the other. The final rule also addresses the hazard of damaging and spilling explosives and detonators when using belt conveyors for transportation. One commenter suggested that in mines where there is a means of transporting explosives and detonators other than conveyor belts, the final rule should require the other method to be used. In MSHA's experience, tranportation of explosives and detonators by conveyor belt is safe, provided that the precautions prescribed by the rule are followed. When dangerous circumstances have been created during transportation of explosives and detonators by conveyor belt, they have been the result of collisions with obstructions or unsafe handling practices at transfer points or when unloading.

Like the proposal, paragraph (c)(1) provides that at least 6 inches of clearance must be maintained between the top of any container of detonators or explosives and the mine roof, or other obstruction along the conveyor belt. A commenter suggested that a minimum of 18 inches of clearance be required to be maintained between the top of containers of explosives and detonators and the mine roof or other obstruction. The final rule requires 6 inches of clearance instead of 18 inches because the required clearance is both adequate and reasonable to protect against damage to or spilage of explosives and detonators. It also accounts for vertical movement of the containers at uneven locations along a beltline, while recognizing the confined nature of the underground environment.

Except when persons are riding the belt to accompany explosives or detonators, a person must be at each transfer point between belts and the unloading location. This exception has been retained from the proposal recognizing that these persons would be in a position to stop the belts at these transfer and unloading points. Conveyor belts are also required to be stopped before explosives or detonators are loaded or unloaded. This new provision has been added to the final rule in response to a comment and is based on MSHA's assessment of several hazards associated with working around moving conveyor belts. An MSHA study, presented at the Fourteenth Annual Institute on Coal Mining Health and Safety at Blacksburg Virginia in 1983, on transportation and materials handling during the period from 1975 to 1982 showed 50 persons of all accidents associated with handling materials in underground coal mines to be conveyor related. Stopping the belt before loading or unloading allows stable positioning of cartons thereby reducing the potential of explosives and/or detonators from being carried over a belt tailpiece causing damage or detonation. It also protects against the hazard of miners being pulled into the moving belt during the course of handling containers.

Paragraph (d) addresses transportation of explosives and detonators by hand. It requires that they be carried in separate, nonconductive containers to keep explosives from coming in contact with initiating devices and to protect explosives and detonators from external electric sources. The original containers, rubberized bags or other nonconductive containers may be used to comply with this provision. The use of rubberized bags when transporting explosives and detonators by hand has proven to be safe.

The provision addressing hand-carried explosives and detonators was inadvertently left out of the proposal. MSHA recognizes that hand-carrying is likely to be used at some point when transporting explosives and detonators to the place of use. Therefore, this provision has been added to the final rule.

Section 75.1312 Explosives and detonators in underground magazines.

The final rule is derived from existing § 15.19(b) and §§ 75.1301, 75.1306 and 75.1307, except for paragraphs (c), (f) and (g) which are new. The rule establishes basic requirements for explosives and detonators kept in underground magazines and places

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limits on the quantity of explosives permitted underground.

Paragraph (a), like the existing rule, limits the quantity of explosives kept in underground magazines to no more than is needed for 48 hours of use. This quantity limit, which remains unchanged from the proposed rule, will vary at each mine according to the amount of explosives used in the operation. Limiting the amount of explosives underground protects against a large quantity of explosives being involved in a mine fire or explosion.

One commenter recommended a limit on both the quantity and time during which explosives may be stored, suggesting that only amounts needed and used within a 24-hour time period be permitted. Other commenters expressed concern that the proposed 48-hour period could lead to enforcement problems since usage may vary at a particular mine for any 48-hour time period, particularly for an operator who does not use explosives for the extraction of coal. One commenter recommended eliminating this requirement and suggested using instead a standard which addresses removal of deteriorated explosives from the mine. This commenter expressed the view that manufacturers have achieved a safe level of product stability and that the 48-hour standard would not address the hazards associated with excessive quantities of explosives stored underground. Another commenter stated that a 48-hour supply rule would be too restrictive, leading to increased handling and miner exposure to hazards transporting explosives. This commenter recommended a 7-day storage supply limitation.

The final rule limits the quantity of explosives kept underground to that amount expected to be used within 48 hours. Some commenters were confused at the public hearing as to the meaning of the quantity limit. MSHA emphasizes that the 48-hour rule is not a time limit for storage underground which requires that explosives be removed after 48 hours. Instead, it is a quantity limit on the volume of explosives stored underground, the quantity being that amount which would normally be used in the operation over 48 hours. To avoid unnecessary handling of explosives, MSHA has interpreted the existing standard in this manner and it has been industry practice for more than 30 years.

Paragraph (b) requires that explosives and detonators taken underground be kept in separate closed magazines at least 5 feet apart, or in the same closed magazine with the explosives and detonators separated by a hardwood partition at least 4 inches thick, separated by a laminated partition or equivalent. This standard remains basically unchanged from the proposed rule and addresses the need for careful storage of explosives and detonators as a basic precaution against damage and accidental detonation. Keeping explosives and detonators in either separate closed magazines or in the same closed magazine with the explosives and detonators separated by at least a 4-inch hardwood partition, a laminated partition or the equivalent minimizes the potential detonation of explosives in the event that the detonators are accidentally initiated.

Paragraph (c) requires that only explosives and detonators be kept in underground magazines and is substantially unchanged from the proposal. The proposed phrase "stored underground" is revised to read "kept underground" to clarify that explosive and detonator supplies be limited as prescribed by paragraph (a) of this section. Under the final rule, no materials other than explosives and detonators are to be kept in underground magazines. This standard prohibits the accumulation of empty packing material, combustible material and other items which could contribute to a fire or accidental detonation.

Paragraph (d) also remains unchanged from the proposed rule. It requires that magazines be substantially constructed and all interior surfaces be made of nonconductive material with no metal or other conductive material exposed inside. MSHA recognizes that metal exteriors have been effectively used to protect stored explosives and detonators from accidental detonation and damage. This rule permits the use of mobile magazines as well, provided that they meet the requirements of the final rule. A commenter also suggested that a provision be added to the final rule which would require all magazines to be immobilized while containing explosives. The commenter stated that all magazines must be stationary and in a known location outby the face to avoid the potential of equipment accidentally damaging a mobile magazine because of its unknown location. As discussed below, magazine locations are required to be posted with readily visible warnings to provide adequate notice of the location of explosives. These warnings on the magazine alert miners when magazines are moved to a new location. MSHA is not aware of any accidents regarding explosives and detonators in mobile magazines resulting from the magazine being either hit and damaged by mining equipment or by the magazine itself becoming a runaway piece of equipment. Most magazines are of skid-mounted type and are portable rather than mobile. Therefore, this recommendation is not adopted in the final rule.

Paragraph (e), which is consistent with both the proposal and the existing standard, requires that magazines be at least 25 feet from roadways and any source of electric current. Magazines must also be out of the direct line of the forces from blasting and be kept as dry as practicable.

One commenter suggested that all magazines be located at least 150 feet outby the last open crosscut. This suggestion has not been adopted. In MSHA's experience, the precautions of paragraph (e) provide a necessary and reasonable measure of protection against the hazards of an accidental explosion or other hazards involving explosives and detonators in magazines Locating the magazine 25 feet from any roadway will keep it out of areas of concentrated mine traffic where the magazine might be struck by equipment Keeping the magazine out of the direct line of the force of blasting protects the explosives supply from being damaged or accidentally initiated. When the magazine is kept as dry as practicable, damage to or deterioration of the explosives and detonators while they are stored in the magazine is minimized

Paragraph (f) requires that magazine locations be posted with indelibly marked, readily visible warnings indicating the presence of explosives. One commenter recommended that the warning be made of reflective material with lettering at least 6 inches tall and that these signs be located at all points where persons entering the area would pass. The warnings required by the fina rule must be indelible and sufficiently marked in a fashion that is readily visible, indicating the location of a magazine. This will require warnings that alert persons entering the area of the contents in the magazine, which is the purpose of this standard. The particular method by which this is accomplished, however is not specified in the final rule. Instead, the mine operator can determine how to appropriately label the warning signs.

Paragraph (g) specifies that only materials and equipment used in blasting such as blasting units, blasting cable, and tamping sticks can be stored at magazine locations. This is unchanged from the proposed rule. This provision differs from paragraph (c) in that it limits the items that can be stored in areas surrounding magazine locations while paragraph (c) limits the materials that can be stored inside an

underground magazine. Paragraph (g) does not permit the storage of combustible material or empty packaging at these locations. This will minimize the risk of fire and premature initiation of the explosives and detonators.

One commenter suggested that underground storage of explosives and detonators be prohibited in any mine that does not use explosives to produce coal on a regular basis. The commenter stated that this would eliminate deterioration of explosives and detonators when stored for a long period of time. When explosives and detonators are stored in accordance with the final rule, the incidence of deterioration will be minimized. However, when deterioration of the explosives and detonators does occur, the final rule specifies that they be removed from the mine. In addition, the Agency is not aware of any data which indicates that problems are being encountered in underground coal mines as a result of this practice. For these reasons, this suggestion is not adopted in the final rule.

Section 75.1313 Explosives and detonators outside of magazine.

The standards in this section are derived from existing §§ 75.1301, 75.1304, 75.1306 and 75.1307 except for paragraphs (a) and (c) which are new. They address the handling of explosives and detonators that are removed from magazines for use. These standards are not changed substantially from the proposed rule except for paragraph (a) which, although not in the proposal, was a new provision in the preproposal draft.

Paragraph (a) is a new requirement which limits the quantity of explosives that can be outside a magazine for use in a working section or other area where blasting is to be performed to 100 pounds except when more than 100 pounds of explosives are required to blast one round. In the latter situation, the amount necessary to blast one round may be outside of the magazine. These limitations were in the preproposal draft but were not included in the proposal. At least 10 fatalities have occurred where explosives being stored on mining equipment accidentally detonated when the coal face was blasted. Upon reconsideration of this accident data and in response to a comment urging that a limitation on the amount of explosives outside a magazine be specified, this provision has been added to the final rule.

In addition, when excessive quantities of explosives are outside of a magazine they are subject to being misplaced and run over by mining equipment. This limitation will protect against accumulation of explosives on a working section or other area of a mine. This will also lessen the severity of an accident involving premature detonation of explosives.

The 100-pound limitation is based on the fact that explosives are normally stored in 50-pound cases. An allowance of 100 pounds of explosives outside of a magazine is more than enough to blast a round of coal. In certain instances, such as when blasting rock overcasts, MSHA recognizes that more than 100 pounds of explosives may be necessary. Paragraph (a)(2) of this section allows an operator the needed flexibility to do blasting under those special circumstances.

Paragraph (b) requires that explosives and detonators outside a magazine that are not being transported or prepared for loading in boreholes be kept in closed separate containers made of nonconductive material with no metal or other conductive material exposed inside. The containers must be at least 15 feet from any source of electrical current, out of the direct line of the forces from blasting, in a location to prevent damage by mobile equipment, and kept as dry as practicable. This paragraph is unchanged from the proposed rule.

One commenter suggested deleting the requirement that explosives and detonators be kept as dry as practicable because virtually all explosives and detonators are water resistant. Water gel and emulsion type explosives are wrapped in plastic and may not be affected by water. However, some granular-type explosives are wrapped in paper cartridges which are subject to water deterioration.

The 15-foot distance which must be maintained between the explosives and detonators and any source of electric current has proven to be an effective distance in preventing accidental initiation. Keeping the detonators and explosives out of the direct line of the forces from blasting normally means keeping these materials out of the section or area where blasting is conducted. When the explosives or detonators are kept in a location to prevent damage by mobile equipment, the possibility of accidental contact which could initiate detonation is lessened.

Paragraph (c) is a new provision which requires that explosives and detonators not used during the shift be returned to a magazine by the end of the shift. This paragraph is unchanged from the proposed rule. One commenter suggested that MSHA clarify that the provision allows storage in a section magazine at the end of a shift and does not require that explosives and detonators be carried outside of the mine to the main magazine at the end of a shift. MSHA does not believe that any additionally clarification is needed. The regulation permits the operator to use either the section or the main magazine so long as it meets the requirements of these standards.

A commenter recommended that MSHA require only qualified persons to return unused explosives to a magazine at the end of the shift. MSHA has not adopted this recommendation because the primary concern addressed by the qualified person requirement is the safe use of permissible explosives. These type explosives are required to be kept in substantially constructed, enclosed containers until used and pose limited hazards to persons handling these containers. Consequently, a qualified person is not required for transporting explosives into or out of the mine or for removing explosives from a magazine. The Agency believes, that since similar circumstances exist when returning explosives to a magazine, the need for a qualified person to perform this task does not exist.

Section 75.1314 Sheathed explosive units.

This new section sets forth the conditions under which sheathed explosive units may be used in underground coal mines. Other general requirements in the final rule for transportation, storage and handling of explosives also apply to the sheathed explosive units. The sheathed explosive unit, which was developed by the Bureau of Mines, U.S. Department of the Interior, can be fired outside the confines of a borehole without presenting the hazard of igniting any flammable atmosphere which might be present underground. Existing standards currently prohibit the firing of any explosives in bituminous coal mines that are not confined in a borehole. Sections 75.1310 and 75.1315 of the final rule allow the use of sheathed explosive units and § 75.1314 sets forth requirements for their use. Situations where it may be advantageous from a safety standpoint to fire the sheathed explosive unit include dislodging loose roof slabs or coal or rock overhangs, roof fall leveling, and slab or boulder breaking.

One commenter recommended that the use of sheathed explosive units be prohibited. This commenter stated that permitting the use of sheathed units would allow unconfined shots to be fired in underground bituminous coal

mines resulting in a diminution of safety for the miners. Historically, the firing of unconfined shots has been prohibited. The sheathed explosive unit is designed to form a flame-inhibiting cloud upon firing of the unit. This cloud will prevent the flame created by firing of the explosive from igniting any explosive mixtures that may be present. The Bureau of Mines conducted numerous tests on its prototype sheathed explosive units to determine whether they would ignite explosive mixtures of methane or coal dust. During these tests the units were placed in a gallery containing explosive mixtures and fired. The firing of these units did not ignite any of the explosive mixtures. The tests conducted by the Bureau of Mines clearly show that sheathed explosive units can be used safely in underground coal mines, provided that the applicable provisions of this final rule are followed.

In addition, MSHA is issuing, concurrently with this final rule, approval requirements for sheathed explosive units. As previously discussed, sheathed explosive units must be approved by MSHA before they can be used in underground coal mines. These approval requirements are included in the revisions to 30 CFR Part 15.

Paragraph (a) of the final rule specifies that an instantaneous detonator must be used to fire each sheathed explosive unit. This paragraph remains essentially unchanged from the proposal, except the term "each" has been added to clarify that each sheathed explosive unit must be initiated by a separate instantaneous detonator for firing. The exclusive use of instantaneous detonators with sheathed explosive units protects against the hazards associated with sheathed explosive units being damaged by the earlier firing of an adjacent unit.

One commenter stated that short-delay detonators with the same delay periods could be used because the identical delays would ensure that the blast is essentially instantaneous. Tests conducted by the Bureau of Mines on short-delay detonators indicate that firing times for the same delay period can vary significantly. For example, a short-delay detonator with a designated delay period of 100 milliseconds could detonate in a time period ranging from 75 to 125 milliseconds. Therefore, if short-delay detonators are used in sheathed explosive units, one unit could fire before the others, thereby causing damage to the flame-inhibiting sheaths of adjacent units, and resulting in an ignition of coal dust or methane. Because of this potentially hazardous situation, the final rule specifies that instantaneous detonators be used when firing sheathed explosive units.

Paragraph (b) requires that a qualified person or a person working in the presence of and under the direction of a qualified person must prime and place the sheathed explosive units into position for firing. This paragraph also specifies that when priming a sheathed explosive unit the entire detonator must be inserted into the detonator well of the unit and be secured in place. Correct priming and placement of sheathed explosive units, like all other explosives, are crucial to safe performance. The final rule clarifies the proposal which specified that a person be under the immediate supervision of a qualified person. Under the final rule, when the sheathed explosive units are primed and placed by other than a qualified person, it must be done in the immediate presence of and under the direction of a qualified person.

The requirement in paragraph (b) regarding the method for priming the sheathed explosive unit appeared in the preproposal draft but not the proposed rule. Upon reconsideration, MSHA believes that because the sheathed explosive unit is relatively new, a requirement for how it is to be primed is necessary to reduce the hazards associated with improper detonator placement. Placing the detonator in the detonator well of the sheathed explosive unit initiates the explosive in the unit without damaging the sheath. Detonators improperly placed, could only partially detonate the explosive and damage the flame-inhibiting sheath. Damage to the flame-inhibiting sheath might then allow the explosive to ignite gas or dust in the mine atmosphere. The final rule also requires detonators to be secured in place to prevent movement of the detonator prior to initiation.

Paragraph (c) requires that sheathed explosive units not be primed until immediately before the units are placed where they will be fired. This paragraph is unchanged from the proposal. It addresses the hazard of prime sheathed explosive units being exposed in the underground mine environment for extended periods of time without being used, increasing the likelihood of accidental detonation. The priming of the sheathed explosive units is the last step in preparation of the explosives before the units are placed where they will be fired. The final rule minimizes the amount of time an explosive remains primed prior to firing.

Paragraph (c) requires that a sheathed explosive unit not be primed if it is damaged or deteriorated. The final rule revises the proposal which specified that a sheathed explosive unit not be fired if it is damaged or deteriorated. The final rule does not permit damaged or deteriorated sheathed explosive units to be primed. A qualified person will be able to visually inspect the sheathed explosive units before preparing them for detonation to determine if a sheathed explosive unit is damaged or deteriorated. Damaged or deteriorated sheathed units increase the potential for a misfire.

Paragraph (d) requires that rock dust be applied to the roof, ribs and floor within a 40-foot radius of the location where the sheathed explosive units are to be fired except in anthracite mines. This paragraph appeared in the preproposal draft but not the proposed rule. This application of rock dust helps protect against the hazards of float coal dust and coal dust being placed into suspension when the sheathed explosive unit is fired. In addition, it ensures that rock dust is applied in areas which are not covered by the MSHA requirement that generally addresses rock dust applications (30 CFR 75.402).

Paragraph (e) of the final rule provides that no more than three sheathed explosive units be fired at one time. This paragraph remains unchanged from the proposal. The use of three sheathed explosive units at one time should be adequate for application in underground coal mines. The simultaneous firing of three units is the maximum number of units that have been tested by the Bureau of Mines in an explosive atmosphere. These tests have shown that the proper firing of three units does not create an ignition hazard. One commenter, who had observed testing of sheathed explosive units by the Bureau of Mines, stated that in his opinion, three units provided ample rock breaking capacity to break the strongest strata associated with roof falls and excavation.

Paragraph (f) requires, as did the proposal, that sheathed explosive units not be fired if they are in contact with another sheathed explosive unit. This is in accordance with the test procedures used by the Bureau of Mines to determine the safety of firing sheathed explosive units. In addition, this will minimize the possibility that the concussion created by the firing of a unit will damage the flame inhibiting sheath of an adjacent unit and adversely affect the safety aspects of its performance.

Several commenters suggested that the term "sheathed explosive unit" be replaced with the phrase "explosives approved for unconfined blasting". They stated that the term "sheathed explosive

unit" may limit technological advances and prevent the use of devices that are as safe as sheathed explosive units. The term "sheathed explosive units" is used in the final rule primarily to distinguish them from other types of explosives and should not be interpreted as limiting the introduction of other devices designed to be fired outside of boreholes. The approval provisions in Part 15 and the requirements of § 75.1315 allow for the future introduction of other such explosive units approved by MSHA.

Section 75.1315 Boreholes for explosives.

This standard is derived from existing §§ 75.1300, 75.1302, and Part 15 except for paragraphs (d), (e), and (f) which are new. It addresses unconfined shots and the use, spacing and maintenance of boreholes. These requirements will minimize the occurrence of gas and coal dust explosions and misfires.

Paragraph (a) requires that all explosives fired in underground coal mines be confined in boreholes except sheathed explosive units and other explosive units approved by MSHA for firing outside the confines of a borehole and shots fired in anthracite mines for battery starting or blasting coal overhangs. The final rule revises the existing requirement by allowing the use of sheathed units and deleting the terms "mud caps and adobes". Unconfined shots continue to be prohibited by the requirement that explosives fired underground be confined in boreholes, except when firing sheathed explosive units or other explosive units approved by MSHA under Part 15.

When explosives are fired, they create sufficient flames to ignite coal dust and methane. However, if the explosives are stemmed in a borehole, the flame is confined in the borehole and cannot ignite any coal dust or methane that may be present. This same principle is true for sheathed explosive units which upon firing create a cloud of flame-inhibiting material and prevent the flames from causing an ignition.

One commenter recommended that battery starting in anthracite mines be accomplished with means other than the use of unconfined blasting to prevent exposing miners to unnecessary hazards. The final rule allows unconfined shots to be fired in underground anthracite mines for battery starting and when taking down coal overhangs. These practices have been performed in anthracite mines for many years. Unlike bituminous coal dust, anthracite coal dust is not explosive and therefore does not present the same hazard as bituminous coal dust. However, as with all blasting, § 75.1324 prohibits any round from being fired unless the methane concentration in the area is less than 1 percent volume.

The final rule also prohibits persons from going inside a battery to start the flow of material. This requirement, which is an existing provision, was inadvertently omitted from the proposed rule. The Agency believes that due to the severe hazard of being struck and or crushed by falling material which is associated with this practice, it must be specifically prohibited.

Paragraph (b) requires boreholes for explosives in coal to have a distance of at least 24 inches between the boreholes and between each borehole and any free face, unless the height of the coal seam does not permit such spacing. This revises the existing standard which requires a burden of 18 inches in all directions. MSHA's experience, as well as that of several commenters, has shown that this language is subject to a variety of interpretations and leads to confusion. Therefore, the phrase "burden * * * in all directions", as used in existing Part 15, is deleted in the final rule.

Research conducted by the Bureau of Mines has indicated that, in order to minimize the potential for desensitization of explosives being fired in coal, a minimum spacing of 24 inches is necessary. The shockwaves created by the firing of explosives in a borehole can compress the explosives in an adjacent borehole if the spacing is less than 24 inches. When explosives are compressed, their density is changed and the likelihood of a misfire is significantly increased. Results of research conducted by the Bureau of Mines indicates that misfires occur approximately 50 percent of the time when the separation between boreholes is only 18 inches. The occurrence of misfires was significantly reduced when the spacing between the boreholes was increased to 24 inches.

Several commenters stated that a 24-inch spacing of boreholes would be too great a distance when blasting rock in combination with coal (middle man). They stated that such spacings would result in oversized rocks and reduce the overall effectiveness of the shot. Some of these commenters recommended that the existing 18-inch spacing be retained, while others recommended that a provision be added which would allow District Managers to permit distances less than 24 inches.

Paragraph (c) has been added to the final rule to address the concerns of these commenters. It requires boreholes in rock to be at least 18 inches from any other borehole in rock, at least 24 inches from any borehole in coal, and at least 18 inchres from any free face. This recognizes that rock is a harder material than coal and the distance between boreholes necessary to prevent desensitization of explosives is less. However, when a combination of rock and coal are blasted simultaneously, any borehole in rock must be at least 24 inches from any borehole in coal.

Paragraph (d) prohibits a borehole that has at any time contained explosives from being used to start any other hole. This provision addresses the hazard of accidentially drilling into undetonated explosives or detonators remaining in a previously loaded borehole. Miners have been fatally injured while drilling into holes that contained misfired explosives.

Paragraph (e) requires that when blasting slab rounds off the solid, the opener holes not be drilled beyond the rib line. Boreholes drilled beyond the rib line can result in overburdened shots which contribute to the ocurrence of blown-out shots and an increased risk of methane and dust ignitions.

Paragraph (f) provides that when coal is cut for blasting, the coal must be supported if necessary to maintain the stability of each borehole to be loaded with explosives. This provision appeared in the preproposal draft, but was not in the proposal. A commenter objected to this deletion because boreholes may collapse after being loaded. Boreholes which collapse or are otherwise affected by sagging or collapsing of cut coal can result in unconfined or blown-out shots. For example, if explosives are loaded into boreholes in a working place which has been undercut to a depth of 10 feet and the first 3-foot distance of the cut then sags or collapses, the explosives may be separated from the stemming material allowing the shots to be fired unconfined. A common practice for supporting the coal in such situations is placing a few blocks of wood in the undercut area of the face. Therefore, MSHA has revised the final rule to include this requirement.

Section 75.1316 Preparation before blasting.

This final rule is derived from existing § 75.1307 and Part 15, except paragraph (d) which is new. This section sets forth the requirements for deenergizing or removing electric equipment and determining the depth and direction of boreholes. It also identifies situations when explosives are not permitted to be loaded in boreholes. It address the hazards of premature detonation of the explosives being placed in boreholes.

Paragraph (a) requires that before priming explosives, all mobile electric equipment be removed to a distance of 50 feet from the working place or any other area where blasting is to be performed. This paragraph also requires that stationary electric equipment within 50 feet of these areas be deenergized. Failure to deenergize these sources increases the risk of accidental initiation of detonators and explosives by stray electric current.

The 50-foot distance for mobile and stationary electric equipment was added to the final rule in response to a commenter who stated that some clarification was necessary to provide guidance to the mining industry as to what equipment should be removed or deenergized. This commenter was concerned that the proposal would be open to a variety of interpretations including the complete deenergization of all electric equipment on a producing section and that such a procedure is not necessary to maintain safe blasting practices. The 50-foot distance, which is an accepted minimum distance used in the coal and metal and nonmetal mining industries, minimizes the potential of premature detonation.

Paragraph (b) specifies that before loading boreholes with explosives, each borehole must be cleared and its depth and direction determined. This provision addresses two primary concerns. First, coal dust created during drilling of the boreholes must be removed from the hole. Otherwise the coal dust can get between the explosive cartridges and prevent the entire explosive train from detonating. The second concern is that the qualified person know the amount of explosives in each borehole based on its depth and that adequate space is provided between each borehole. Determining the depth and direction of each borehole provides sufficient information for making these determinations. Boreholes with excessive amounts of explosive or inadequate spacing of boreholes has resulted in numerous blown-out shots and misfires.

One commenter suggested that a wooden tamping pole or other nonconductive tool be used to clear boreholes and to determine their depth and direction. This commenter stated that only nonsparking tools should be used in preparing boreholes or at any other stage of the blasting process. While a wooden tamping pole is normally used in determining these factors, the use of metallic tools does not present a hazard when clearing boreholes prior to loading explosives and should not be prohibited. At this initial state of the blasting process, there is no danger involved with the borehole because if has not yet been loaded with explosives. However, § 75.1318(g) of the final rule requires that only a nonconductive, nonsparking pole be used when loading explosives into the boreholes and when tamping the stemming material.

Paragraph (c) prohibits loading of explosives into boreholes that are drilled beyond the depth of cut coal unless the portion of the borehole deeper than the cut is filled with noncombustible material. Cut coal provides a second free face for the explosives to break the coal down. Firing explosives in boreholes drilled beyond the depth of cut coal increases the risk of blown-out shots and methane or dust ignitions.

One commenter suggested that only clay dummies or water stemming bags be used to fill the portion of a borehole that has been drilled beyond the limits of a cut. This commenter stated that clay or water would be compatible with the boreholes, while other noncombustible materials possibly would not. The purpose of filling the space beyond cut coal is to prevent explosives from being loaded into that portion of the borehole. Therefore, noncombustible materials other than clay or water could also serve this purpose.

Paragraph (d) requires that when two working faces are approaching each other, cutting, drilling or blasting be done at only one working face at a time if the two faces are within 25 feet of each other. Therefore, if a developing crosscut is being mined from both sides, mining operations must be conducted on only one side at a time when the distance between the two working faces is 25 feet or less. This requirement protects against accidental initiation of explosives by preventing cutting or drilling in an approaching working face from coming into contact with boreholes containing explosives on the opposite side. It also guards against blasting breaking through to another area where people are working.

One commenter recommended that this provision apply only during preparation for blasting to avoid possible misinterpretation of the provision. The intent of the provision is to limit any activity related to cutting, drilling, or blasting to only one side when two approaching faces are within 25 feet of each other. This requirement minimizes the potential of premature detonation and also minimizes the number of persons subject to such hazard.

A provision which appeared as paragraph (c) in this section of the proposed rule that addressed the type of work that could be performed when loading boreholes has been moved to § 75.1318 in the final rule.

Section 75.1317 Primer cartridges.

This new standard sets forth requirements for primer cartridges. A primer cartridge is an explosive cartridge with a detonator inserted in one end. Improper makeup of the primer cartridge can adversely affect the reliable detonation of explosives and contribute to the occurrence of misfires, creating safety hazards.

Paragraph (a) requires that primer cartridges be primed and loaded only by a qualified person or a person working in the presence of and under the direction of a qualified person. This requires the qualified person to be in the immediate presence of the person priming explosive cartridges at all times that this work is being performed. Since the hazards associated with explosives and detonators are greatly increased when the two are joined together, a person who is competent and knowledgeable must be present to ensure that proper procedures and precautions are followed.

Paragraph (b) prohibits the priming of cartridges until immediately before they are loaded in boreholes. An explosive cartridge primed with a detonator is very sensitive and subject to accidental detonation. Therefore, the time in which an explosive is allowed to remain primed prior to firing must be minimized.

The proposed rule did not contain certain requirements that were in the preproposal for priming explosive cartridges since they would be prepared by a qualified person proficient in the proper techniques for the performance of these tasks. However, MSHA accident data shows that failure of the blaster to follow safe blasting practices or regulations was a contributing factor in over 80 percent of the fatal blasting accidents from 1978 through 1984. Upon further consideration of this information, MSHA has determined that blasters require more specific guidance in the safe handling and use of explosives. Moreover, commenters did not object to the inclusion of specific instruction on priming in the preproposal. Therefore, paragraphs (c) and (d) have been added to the final rule.

Paragraph (c) specifies that only a nonsparking punch be used when priming explosive cartridges. This specification, appearing in the preproposal draft as nonferrous, was not

in the proposal. The use of a sparking-type punch could create a spark sufficient to cause premature detonation of an explosive. Therefore, only nonsparking punches are permitted.

Paragraph (d) requires detonators to be completely within and parallel to the length of the explosive cartridge and to be secured by half-hitching the leg wires around the cartridge or by an equally effective method. This provision, which was in the preproposal draft, was not in the proposal. Because placement and alignment of detonators in the explosive cartridge is necessary for safe and effective blasting, the Agency addresses these factors in the final rule. Detonators not properly inserted into the explosive cartridge can cause misfires. If a detonator protrudes through the explosive cartridge wrapping and is initiated, the full energy from the fired detonator will not be transmitted to the explosive cartridge and a misfire can occur. Securing the detonator by half-hitching the leg wires around the cartridge keeps the detonator in position while the cartridge is being loaded into the borehole. The use of the half-hitch knot or loop around the cartridge is standard industry practice for securing the detonator. However, the final rule permits other equally effective means of securing the detonators.

Section 75.1318 Loading boreholes.

This section is derived from existing provisions in Part 15, except for paragraphs (a), (c), (d), and (e) which are new. These standards address the procedures for loading boreholes which directly affect the performance of the explosive. Improper loading can contribute to misfires and blown-out shots.

Paragraph (a) provides that explosives must be loaded in boreholes only by qualified persons or persons working in the presence of and under the direction of a qualified person. This requirement addresses the risk of explosives being mishandled at this important phase of the blasting process by untrained persons.

Paragraph (b) requires that when boreholes are being loaded no other work except that necessary to protect persons be done in the working place or other area where blasting is to be performed. This practice reduces the risk of accidental detonations and the number of persons exposed to this hazard in the blasting area. This standard appeared in § 75.1316 in the proposal.

Paragraph (c) addresses procedures for loading boreholes drilled upward in solid rock or long holes drilled upward in anthracite mines. A commenter suggested that pushing all the cartridges to the back of the borehole in a continuous column be restricted to holes that are inclined at an angle of less than 45 degrees from the horizontal. This commenter stated that when loading vertical holes overhead in rock, it would be impossible to load all cartridges in a continuous column. MSHA recognizes that alternative means are necessary to maintain contact between cartridges of explosives in certain circumstances such as vertical boreholes in rock and when drilling long holes upward in anthracite mining. In these cases, some slitting and tamping may be necessary to ensure contact between cartridges and to prevent gaps or separations in the column which could result in misfires. Such slitting and taping will not be considered as damaging the explosives as prohibited by paragraph (e) below. Therefore, the final rule includes alternative means to provide a continuous column of explosives under these circumstances.

Paragraph (d) requires that when loading boreholes the primer cartridge be the first cartridge loaded in the borehole, that the end of the cartridge containing the detonator face the back of the borehole and that the primer cartridge and other explosives be pushed to the back of the borehole in a continuous column with no cartridge deliberately crushed or deformed. Inserting the primer cartridge into the borehole first with the detonator toward the back of the borehole places initiation of the explosives at the point of greatest burden which decreases the potential for blown-out shots. Pushing the explosives to the back of a borehole in a continuous column minimizes gaps and voids between cartridges and damage to them which can interrupt detonation of the column of explosives and result in misfires.

In response to the proposed rule, one commenter suggested that the continuous column be accomplished with no explosive cartridge being crushed. The Agency agrees that explosive cartridges should not be crushed when loading boreholes for blasting coal in bituminous coal mines. Bureau of Mines research conducted in 1949 (Technical Paper 716) shows that crushing explosive cartridges to fill a borehole increases the risk for ignition of methane during blasting as compared to loading cartridges in a continuous train without crushing. In a bituminous coal mine the coal dust is explosive and methane face ignitions have a potential for initiating an ensuing mine-wide coal dust explosion. On the other hand, the risk of a methane or coal dust ignition is greatly reduced when blasting rock. Moreover, anthracite coal dust is not explosive and will not propagate an explosion.

Paragraph (e) prohibits an explosive from being loaded into a borehole if it is damaged, deteriorated or incompletely filled. Using explosives that are not in their approved condition increases the risk of misfires and inadequate performance of explosives.

One commenter suggested that the words "incompletely filled" be deleted. This commenter stated that it is impossible to know if a cartridge is incompletely filled without cutting open the cartridge and examining the contents and thereby damaging, deforming or changing the specifications of the cartridge before firing it. The commenter further stated that it is the explosive manufacturer who has the responsibility for ensuring that a cartridge is completely filled, not the qualified person. MSHA agrees that the manufacturer is primarily responsible for ensuring that the explosives are manufactured as approved, which includes completely filling each explosive cartridge. However, should some incompletely filled products be inadvertently distributed by the manufacturer, those cartridges must not be used.

Incompletely filled cartridges are easily identifiable by visual inspection and by feeling the cartridge in the hands while loading. When an incompletely filled cartridge is squeezed, there is too much play in the material. Also, water gels and some emulsion explosives are in flexible plastic cartridges, and the qualified person can see the amount of material in these types of explosives, as well as feel it. Therefore, this suggestion has not been adopted in the final rule.

Paragraph (f), derived from Part 15, prohibits explosives of different brands, types or cartridge diameters from being loaded in the same borehole. Because of the sensitivity variations of different types of explosives, the use of different types or sizes of explosives in the same borehole can contribute to the occurrence of misfires.

Several commenters recommended that this paragraph be deleted. These commenters stated that all explosives must pass approval tests so that a mixing of products should not cause problems which would not otherwise occur. During the approval process for explosives, tests are conducted to ensure that cartridges of the same diameter and from the same manufacturer will propagate a detonation properly. Propagation is concerned with the rate at which detonation proceeds down a cartridge.

Different cartridge brands and size have different individual characteristics. When cartridges of the same brand are used together, a predictable result can be obtained which ensures continuous and uninterrupted propagation. No test research has been done to determine whether a mix of cartridge types and diameters can also propagate a detonation properly. Therefore, to ensure a continuous rate of detonation, explosive products must not be mixed.

Paragraph (g) requires that only nonconductive, nonsparking tamping poles be used for loading and tamping boreholes. This requirement, which is derived from existing Part 15, was not in the proposed rule. Commentors recommended that the existing term "nonmetallic" be changed to "nonferrous". The final rule uses the terms "nonconductive" and "nonsparking". The use of these types of tamping poles eliminates the potential for creating sparks that could cause premature detonation. The use of nonsparking connecting devices for extendable tamping poles is permitted by this standard.

In the proposed rule, this section also addressed the use of explosives that are below the approved minimum product firing temperature. Under the final rule, the minimum product firing temperature of explosives is addressed in § 75.1310.

Section 75.1319 Weight of explosives permitted in boreholes in bituminous and lignite mines.

This standard is derived from existing Part 15 and addresses the amount of explosives permitted when blasting coal, coal with rock partings, or fallen rock in bituminous or lignite mines. The use of explosives in excess of the stated limitations can result in excessive flame, coal dust, and methane being released into the mine atmosphere, creating the hazard of a methane or coal dust ignition. Excessive amounts of explosives can also contribute to the occurrence of cut-off shots in adjacent holes.

Paragraph (a) retains the existing 3-pound limit on explosives used in boreholes to blast coal, including coal with rock partings and fallen rock. Several commenters recommended that these requirements not be applicable when blasting fallen materials composed of rock and its surrounding coal strata outby the last open crosscut. While the hazards associated with blasting fallen material outby the last open crosscut may not be as great as in the face area, they still exist. For example, if coal dust and float coal dust present in these blasting areas are placed into suspension by the concussion from the blast, these materials can be ignited by flames caused by the use of excessive explosives. The Agency anticipates that sheathed explosive units will be used in the future to blast the vast majority of fallen material.

As in the existing standard, the final rule does not apply when blasting solid rock in its natural deposit. Blasting solid rock in its natural deposit can require explosives in excess of 3 pounds per borehole to properly blast the rock. Blasting solid rock with an insufficient amount of explosives can result in rock overhangs and loose roof which increase the hazards associated with cleaning up and supporting the area that has been blasted. In addition, the potential for an ignition of coal dust or methane is significantly less than when blasting coal. The proper amount of explosives per borehole depends on the specific circumstances involved. A commenter recommended that the proposed phrase "solid rock in its natural deposit" be replaced with the phrase "rock without mineable coal". This commenter stated that the proposed phrase could be misinterpreted to include sulfur balls and middle man in the coal face. The final rule is consistent with the existing regulation. MSHA is unaware of this provision being misinterpreted in the past.

Paragraph (b) requires a reduction in the weight of explosives by ½ pound for each foot of borehole less than 6 feet.

Section 75.1320 Multiple-shot blasting.

This standard is new, except for paragraph (a) which is derived from § 75.1303, and addresses requirements for detonator use and placement in multiple-shot blasting. Improperly fired multiple-shot blasts can result in blown-out and cut-off shots, both of which have resulted in the ignition of coal dust or methane.

Paragraph (a) prohibits mine operators from firing rounds containing more than 20 boreholes unless permitted in writing by the District Manager under § 75.1321. This provision addresses the hazard of firing more than 20 boreholes in a round which can release additional methane, generate more float coal dust and fumes, and create an increased potential for an explosion. MSHA received no objections to a specific 20-shot limitation in the preproposal draft. On the proposed rule, which was less specific, one commenter stated that 60 shots should be the limit for a round while other commenters stated that a 20-shot limitation should be specified for blasting coal. Most coal production blasting is done with 8–12 shots, with the number of shots varying according to the height or width of the coal. The need for blasting more than 20 boreholes more frequently occurs in development or construction work in rock, which would be permitted under § 75.1321.

Paragraph (b) prohibits instantaneous detonators and delay detonators from being used in the same blasting circuit in any underground coal mine. This practice, which would not have been specifically prohibited by the proposal, was added to the final rule in response to the recommendation of numerous commenters. These commenters pointed out, and MSHA agrees, that because of the different firing characteristics and firing times of instantaneous and short-delay detonators, the likelihood of misfires and the potential for blown-out shots is significantly increased when they are used in the same circuit.

Paragraph (c) is applicable to bituminous and lignite mines and specifies that only detonators with delay periods of 1,000 milliseconds or less be used when blasting in these mines. This constitutes an editorial change to conform to the definition of short-delay detonators and permits the use of instantaneous detonators. These are the only types of detonators that have been used in recent years and have proven to be safe and effective. They control the total elapsed blasting time of a round while minimizing the possibility of a methane or coal dust explosion.

A commenter suggested that the use of instantaneous detonators be prohibited. This commenter stated that short-delay detonators should be required in all mines and if exceptions are needed, a variance could be granted by the District Manager. The vast majority of detonators that will be used underground will be short-delay. However, as previously discussed, instantaneous detonators are required to be used when firing sheathed explosive units. They may also have some application when blasting rock. Instantaneous detonators can be safely used in these situations and to require that the use of instantaneous detonators be approved by the District Manager will create an unnecessary paperwork burden on the mining industry.

Consistent with this approach, the proposed requirement that short-delay detonators be used for multiple-shot blasting in anthracite mines when required by the District Manager is not included in the final rule. Upon further review, the Agency has determined that short-delay detonators are not typically used in anthracite mines and the need for their use in the foreseeable future is limited. Because of the different

characteristics of the coal seams, mining methods, and blasting techniques used in anthracite mines, long-delay detonators and instantaneous detonators are more appropriate for multiple-shot blasting. MSHA has no data or information to indicate that this practice is unsafe. However, as discussed above, instantaneous and delay detonators cannot be used in the same blasting circuit.

Currently, the total elapsed blasting time for short-delay electric detonators used in underground coal mines is limited to 500 milliseconds. However, research conducted by the Bureau of Mines, in conjunction with MSHA, has provided evidence that this time period can be extended to 1,000 milliseconds without increasing the risk of a methane or coal dust explosion. Accordingly, the final rule defines "short-delay detonator" as a detonator with a designated delay period of 25 to 1,000 milliseconds.

Paragraph (d) requires that each borehole in a round be initiated in sequence from the opener hole or holes in anthracite mines. The provision was in the preproposal draft and not in the proposal. Upon reconsideration, the Agency has determined that this is an important factor for blasting in anthracite mines and thus, it is addressed in the final rule. Since an opener hole is the first hole fired, it creates a second free face to provide additional relief for the remaining boreholes. This requirement provides for an orderly, controlled blast and prevents blown-out shots, cut-off shots and structural damage to the rib, roof, or ventilation system on steeply pitching seams.

Paragraph (e) addresses arrangement of detonator delay periods when blasting in bituminous and lignite mines. For blasting cut coal, this provision requires the first shot fired in the round to be initiated in the row nearest the kerf or shear. A kerf is a horizontal cut that is created by removing the coal near the bottom of the coal face with a cutting machine. On the other hand, a shear is a vertical cut that is created by removing a portion of the coal near the middle of the coal face or along each side. Both kerfs and shears provide a second free face for relief of the coal when the explosives are fired.

Paragraph (e)(1)(ii) addresses the interval between the designated delay periods of successive shots when blasting cut coal. The provision requires the interval to be at least 50 milliseconds, but not more than 100 milliseconds. The proposed requirement did not establish a range for the interval although the preproposal did specify such a range for sequential firing.

The interval between the designated delay periods of successive shots is an outgrowth of previous experimental research work conducted by the Bureau of Mines on multiple shot short-delay blasting. The interval established in this section of the rule is also supported by research performed in Great Britain and Western Europe and is a published recommendation of the Institute of Makers of Explosives. The research work has been published in International Conferences of Directors of Safety in Mines Research and in formal Bureau of Mines publications which are in the public domain. Establishing an upper limit of 100 milliseconds during sequential firing reduces the potential for ignition of gas or dust liberated during the firing of each successive shot. It also minimizes the potential for ignition from cut-off shots. The absence of an upper limit increases the probability of an explosion caused by explosives not being properly confined in a borehole and thus firing in a flammable atmosphere. Based on this technical data, MSHA has added this requirement to the final rule.

Paragraph (e)(2) addresses the arrangement of detonators and the interval between the designated delay periods of successive shots when blasting coal off the solid. When blasting coal off the solid, the provision requires each shot in the round to be initiated in sequence from the opener hole or holes. The firing of shots in sequence establishes a free face for successive shots, thereby reducing the potential for a blown-out shot. The required interval between successive shots when blasting coal off the solid is also based on experimental work by the Bureau of Mines in short-delay blasting.

Several commenters recommended the prohibition of blasting coal off the solid. Two multiple fatal blasting accidents were cited as justification for the prohibition. These commenters stated that blasting off the solid is a known hazard which is not economically justified. However, the Agency does not prohibit blasting off the solid in the final rule. Requirements in the final rule are directed to conducting blasting off the solid in a safe manner. The requirements control the amount of explosive used, provide for proper stemming and tamping, address placement of boreholes, regulate the sequence of firing, specify intervals between shots, and place a limitation on total elapsed blasting time not to exceed 1,000 milliseconds. In addition, the final rule contains more stringent requirements for the qualified persons who handle and use explosives. The Agency's investigation of the Adkins Coal Company explosives accident on December 7, 1981, and the FHR Coal Company explosives accident on January 20, 1982, which together resulted in 15 fatalities, revealed that although the technique of blasting coal off the solid was employed at these two mines, multiple violations of MSHA standards relative to the safe use of permissible explosives were cited as the cause of these accidents.

Section 75.1321 Permits for firing more than 20 boreholes and the use of nonpermissible blasting units.

This provision clarifies existing § 75.1303–1 which allows District Manager approval for firing more than 20 boreholes in a round and the use of nonpermissible blasting units. MSHA's experience has shown that mine operators have utilized it to obtain permits to use nonpermissible blasting units to fire large numbers of boreholes during construction blasting in rock. The removal of this provision from the proposal was based primarily upon the belief that permissible blasting units would be available to meet the mining industry's needs. However, MSHA has determined that, at this time, permissible blasting units do not have sufficient capacity to perform all development and construction blasting required by the industry. Therefore, the provision in the existing rule that permits the District Manager to authorize the firing of more than 20 boreholes per round and to use nonpermissible blasting units has been retained with minor editorial revisions, in the final rule.

Section 75.1322 Stemming boreholes.

This proposal is derived from existing § 75.1303 and Part 15, except paragraphs (b), (c), (f), (g), and (h) which are new. It sets forth procedures and requirements for stemming boreholes. Stemming in boreholes acts to suppress the flames during blasting. Failure to properly stem boreholes can result in blown-out shots.

Paragraph (a) requires only noncombustible material to be used for stemming boreholes. A commenter recommended deletion of the word "noncombustible" stating that the terminology would have allowed rock dust and wet sand bags to be used as stemming. It was also recommended, that stemming materials be restricted to clay and water. The final rule, like the existing provision, requires noncombustible material for stemming. Restricting use to clay and water would

limit the type of stemming material and not permit use of materials that could be as equally effective.

Paragraph (b) specifies that stemming material, except water bags, must be tamped to fill the entire cross-sectional area of the borehole. This requirement was not contained in the proposed rule but was included in the preproposal draft. Upon further review by the Agency, specific language is included in the final rule to require the tamping of stemming materials to fill the entire cross-sectional area of the borehole. Stemming material must be tamped to prevent flames from escaping when a borehole is fired.

Paragraph (c) requires that the stemming materials in each borehole contact the explosive cartridge nearest the collar of the borehole. Space or gaps between the stemming material and the explosives can significantly reduce the effectiveness of stemming in confining the flames generated by the initiation of explosives.

Paragraphs (d) and (e) specify the minimum amounts of stemming material to be used based on the depth of the borehole. Experience has shown these minimum amounts to be adequate for confining the flame generated by the initiation of explosives. When clay dummies, moist sand, loose clay, or other noncombustible materials are used for stemming, the specified depth of stemming in the borehole must be the depth after tamping.

Paragraph (f) specifies that only pliable clay dummies be used for stemming when blasting off the solid in bituminous and lignite mines. The preproposal provision would have prohibited the use of water stemming bags when blasting coal off the solid. This requirement was not in the proposal. In lieu of only allowing blasting off the solid where permitted by the District Manager, as required in the preproposal, the final rule instead provides stringent requirements for controlling this practice. One of these is the requirement that only pliable clay dummies be used as stemming when blasting off the solid which has been included as recommended by commenters. The use of pliable clay dummies provides additional resistance against blown-out holes which may result in a methane or coal dust ignition.

Paragraph (g) requires that the diameter of a water stemming bag and the diameter of the drill bit used to drill the borehole be within ¼ of an inch. The primary purpose of a water stemming bag is to provide a wall of water within the borehole to confine flames generated by the initiation of the explosives. The Bureau of Mines and MSHA have determined through tests that a spacing of not more than ¼ of an inch between the water stemming bag and the walls of a borehole allows the water to form a complete wall within the borehole and prohibits the flames from escaping into the mine atmosphere. However, tests have not been conducted on spacings greater than ¼ of an inch and therefore the rule limits the spacing to a known safe value.

Paragraph (h) sets forth those performance characteristics for tear- and flame-resistance of water stemming bags which are commercially available for use in underground coal mines. The preproposal specified that water stemming bags be approved by MSHA, but this provision was not included in the proposal. In the absence of approval requirements, the Agency added the performance characteristics of flame resistance and tear resistance in the final rule so that safe water stemming bags will be provided for use when blasting cut coal. The flame resistant property reduces the fire hazard of a water stemming bag that is shot out of a borehole into a flammable atmosphere during blasting. The tear resistant property minimizes the potential for a water bag to rip or lose its water holding capability while used to stem a borehole. The inclusion of these performance characteristics in the final rule is in response to comments which stated that the proposed rule would have permitted the use of untested systems.

Section 75.1323 Blasting circuits.

The final rule is derived from existing Part 15, except for paragraphs (b), (f), (g), (h), (i) and (j), which are new. The final rule establishes the requirements for the use and protection of blasting circuits, including the blasting cable. To ensure reliable detonation of explosives and to reduce the risk of misfires and premature or unplanned detonation, devices used in the blasting circuit must be appropriate for their intended purpose and properly maintained.

Paragraph (a) requires blasting circuits to be protected from stray electric current. Blasting circuits can become energized by extraneous sources of electricity and protection is necessary to prevent premature initiation of the explosives.

One commenter stated that static electricity is a form of extraneous electricity and should be added to the rule. MSHA agrees that static electricity is a form of stray electricity. However, the Agency has not specifically added "static electricity" to the rule because it is considered to be only one form of stray electricity and is covered by the provisions of the final rule.

Paragraph (b) prohibits the use of detonators made by different manufacturers in the same blasting circuit. Due to sensitivity variations and firing characteristics among detonators, the combining of detonators made by different manufacturers can result in misfires. No objections were raised by commenters to this provision.

Paragraph (c) requires detonator leg wires to be kept shunted until connected to the blasting circuit. As suggested by commenters, the wording of this paragraph has been modified for clarity. When leg wires are not shunted, the detonator is subject to initiation by extraneous electricity. Detonator leg wires are shunted when received from the manufacturer and must remain so until connected into the blasting circuit.

Paragraph (d) requires blasting cables to be well-insulated copper wire of a diameter size not smaller than 18-gauge and long enough to permit the round to be fired from a safe location. In response to a comment seeking clarification concerning the size limitation of the wire gauge, the final rule specifies that the wire diameter be not smaller than 18-gauge. The final rule sets a minimum standard for blasting cable compatibility with the size of capacity of permissible blasting units. Blasting cable lengths must permit the firing of the blast from a safe location that is around at least one corner from the blasting area.

One commenter recommended that the blasting cable be at least 125 feet in length. The commenter objected to the proposed rule because it did not designate a minimum length of blasting cable and, as a result, thought shot firers would be encouraged to shoot from an unsafe location. In response to the commenter, the final rule specifies that the cable be of a sufficient length to reach around one corner from the blasting area. This provides a physical barrier between the blasting area and the shot firer.

Paragraph (e) requires blasting cables to be shunted until immediately before the blast is fired, except when testing for circuit continuity. The connection of the blasting cable to the blasting unit before the round is ready to be fired significantly increases the risk of accidental initiation.

Paragraph (f) requires that wire used between the blasting cable and the detonator circuitry be well-insulated, have a resistance no greater than 20-gauge copper wire, and be not more than 30 feet long. These requirements prohibit the use of wire that is damaged or has a

resistance that may be inconsistent with the capabilities of the blasting unit.

One commenter recommended that the proposed rule increase the resistance from that of 20-gauge copper wire to 18-gauge copper wire based on a calculation that the increased resistance would reduce the current flow adversely affecting the result of the blast. In the final rule, the Agency has specified the wire between the blasting cable and detonator circuitry be not more than 30 feet long and have a resistance no greater than 20-gauge copper wire. The difference in the resistance of 18- and 20-gauge copper wire is insignificant (less than ¼ ohm) for a wire length of 30 feet and therefore the current flow would not be reduced sufficiently to adversely affect the result of the blast.

Paragraph (g) requires that all connections in the blasting circuit be properly spliced and sufficiently separated from other connections to prevent accidental contact or arcing. Poor connections increase the resistance of the blasting circuit. Connections that are too close together or contact each other can result in arcing and or short circuiting and increase the potential for a misfire.

Paragraph (h) requires that uninsulated connections be kept out of water and away from the coal, roof, ribs and floor. The term "bare" has been changed to "uninsulated" for clarity. Failure to protect uninsulated connections can result in loss of electric current through grounding, increasing the potential for misfires. A commenter suggested that these connections also be required to be kept "clean and shiny". The Agency has not adopted the commenter's suggestion since the rule also requires that all blasting circuits be tested for continuity, which will indicate the presence of proper circuit connections and continuity.

Paragraph (i) requires blasting circuits to be wired in a single series when 20 or fewer boreholes are to be fired in a round. This ensures that the resistance of the blasting circuit is compatible with permissible blasting units. One commenter suggested the wording be changed to "all holes to be wired in a 20 or fewer shot series" as opposed to "when 20 or fewer shots are fired in a round". This comment is not adopted in the final rule in order to maintain consistency with the definition of "round".

Paragraph (j) requires that blasting circuits be checked for circuit continuity and resistance using a blasting galvanometer or other instrument specifically designed for testing blasting circuits. This provision differs from the proposal which did not require that blasting circuits be checked for continuity and resistance but only required that certain instruments be utilized if checks for continuity were made. Two of the known causes of misfires are the lack of continuity or excessive electrical resistance in the blasting circuit. MSHA's field experience and assessment of factors and causes of blasting accidents are indicative of the need to check continuity and resistance to prevent misfires during blasting. Review of published recommendations from the Bureau of Mines and British research, recommendations published by the Institute of Makers of Explosives and industry-wide comments regarding the absence of this requirement in the proposed rule support this provision. MSHA has, therefore, modified this rule to require that blasting circuits be tested with a proper instrument for continuity and resistance. This provision minimizes the potential for misfires and eliminates the possibility of accidental initiation of explosives through use of improper checking devices which can carry excessive current capacity. This provision is consistent with circuit testing requirements for metal and nonmetal mines in 30 CFR 56.6121 and 57.6121.

Section 75.1324 Methane concentration and tests.

This standard was in the proposed rule and is derived from existing §§ 75.320 and 75.1302. It addresses methane concentrations and tests in areas where explosives are to be fired. Blasting in areas which contain explosive concentrations of methane can cause mine explosions.

Paragraph (a) prohibits blasting in any area that contains 1.0 volume percent or more of methane. While a one percent concentration of methane in air is not explosive, it is recognized throughout the coal mining community as the level at which steps must be taken to remove the methane.

Paragraph (b) requires that tests for methane be made immediately before shots are fired and that these tests be made by a person qualified to conduct such tests. Methane tests made immediately before the shots are fired provide a warning of methane concentrations at or above 1.0 volume percent.

One commenter recommended the addition of a new provision that would require rock dust to be applied to all surfaces from the face for at least 40 feet in all directions. The commenter stated that the existing standards do not require rock dusting to the face but would permit rock dusting to stop 39 feet from the face. The commenter added that the area surrounding the blast is the critical area that needs the rock dust. The Agency's current regulations in § 75.402 specify that all underground areas of a coal mine be rock dusted to within 40 feet of all working faces. Also, § 75.401 specifies that in working places, particularly in distances less than 40 feet from the face, water, with or without a wetting agent, or other no less effective method must be applied to coal dust on the ribs, roof, and floor to reduce dispersibility and to minimize the explosion hazard. The Agency has not found these safety requirements to be inadequate and, therefore, has not adopted the commenter's recommendation to require application of rock dust to all surfaces from the face for at least 40 feet in all directions.

Section 75.1325 Firing procedure.

This standard sets forth the procedures to be followed when firing explosives. It is derived from existing Part 15 except for paragraph (b) which is new.

Paragraph (a) requires that shots be fired only by a qualified person or a person working in the presence of and under the direction of a qualified person.

Paragraph (b) limits blasting in a working place to one face at a time. One commenter recommended deleting the proposed exception which would have permitted blasting up to three faces in a single working place. The final rule does not allow blasting more than one face at a time. Simultaneous firing of more than one face at a time can release additional methane, generate more dust and fumes, and create a greater potential for an explosion hazard. Another commenter stated the proposal, should limit the numbers of boreholes fired in a round to no more than 20. The final rule in § 75.1320(a) provides that no more than 20 boreholes can be fired in a round unless a permit is granted by the District Manager.

Paragraph (c) requires certain steps to be taken before a blast is fired, including the evacuation of persons from areas where a hazard would be created by the blast, a determination by the qualified person that all persons are a safe distance from the blasting area, and an issuance of warnings that a blast is to be fired. These precautions minimize the exposure of miners to the hazards created by the force of the blast.

Several commenters suggested that the proposed requirement specifying the evacuation of persons when blasting be revised to require them to leave the working place and other areas where a hazard would be created. Commenters

also suggested clarifying that only those persons required to leave need to be around one corner from the blast. In response to these comments, the final rule has been reworded to address these concerns.

One commenter suggested that the verbal warning given before blasting be specific and consistent throughout the industry. The Agency has not adopted specific warning language. It is the responsibility of the qualified person to determine that all persons are a safe distance from the blasting area regardless of the warning given.

Paragraph (d) requires all shots to be fired promply after they are ready to be fired. This practice minimizes the time interval between the warning and firing of the round.

At the request of several commenters, § 75.1324(e) of the proposed rule has been moved and now appears as § 75.1326(c) of the final rule.

Section 75.1326 Examination after blasting.

This standard is derived from existing § 75.1308 and Part 15 and specifies the steps to be taken after blasting. It prohibits entry into the blast area before it is clear of smoke and dust. The concentrations of smoke and dust immediately after the blast can impair the recognition of hazards such as unstable roof and rib conditions. The rule also requires that a qualified person or a person working in the presence of and under the direction of a qualified person examine the area for misfires, methane and other hazardous conditions as soon as the smoke and dust have cleared. An immediate examination after blasting enables prompt action to be taken to correct any hazards resulting from the blast. In addition, the rule requires that if a round has partially detonated the qualified person must leave the area at once and no persons are to reenter the affected area for at least 5 minutes.

Many commenters recommended changing the proposed waiting period of at least 15 minutes found in the proposal at § 75.1324(e), to a waiting period of at least 5 mintues before entering an affected area when a round partially detonates. Commenters stated that the additional waiting period of 10 minutes or more could potentially permit serious problems to develop, particularly in mines where high methane liberation is common. Commenters also stated that partial detonation might result in damage to ventilation equipment in or near the face area and if repairs were not made immediately, dangerous accumulations of methane could occur. Commenters also cited several State laws which impose a 5-minute waiting period before persons are permitted to enter an affected area where a misfire has occurred. Other commenters favored the 15 minute waiting period. The Agency has adopted the waiting period of 5 minutes in the final rule. Should a fire occur from a partially detonated explosive, a longer waiting period may result in the inability to fight and extinguish the fire. The Agency also considered the increased hazard inherent in the accumulation of methane to explosive levels should damage occur to the ventilation system resulting from a protracted period of time before re-entry to the area containing a partially detonated round.

Section 75.1327 Misfires.

This final rule is derived from Part 15 except paragraph (b) which is new. It specifies general procedures to be followed in the handling of misfires. Misfires that are not found and disposed of promptly and safely can be accidentally detonated during loading or other operations, creating the potential for serious injury. Because of varying product performance characteristics, the rule does not specify a particular procedure for handling misfires, but allows a qualified person and mine management to address these situations on a case-by-case basis.

Paragraph (a) limits the work in the area affected by a misfire to that done by a qualified person to dispose of the misfire and other work to protect persons, such as making necessary roof control adjustments. This measure limits the exposure of persons to the hazard of accidental detonation.

A commenter suggested that the area in which a qualified person is working to dispose of misfires should be "dangered off" until the misfire is disposed of. The rule addresses the substance of this commenter's concern by restricting work permitted in the affected area to only that of a qualified person and other work necessary to protect persons.

Paragraph (b) of the final rule, as did the proposal, addresses to steps to be followed when a misfire cannot be disposed of by a qualified person. The rule requires each accessible entrance to the affected area to be posted with a warning to prohibit entry. The rule also requires immediate reporting of undisposed misfires to mine management so that technical assistance can be arranged to safely dispose of the misfire.

One commenter suggested that the information concerning misfires reported to mine management be recorded and maintained as a record signed by the mine foreman. The purpose of the rule is to provide information for mine management that will assist in disposing of misfires and in identifying and eliminating the cause of misfires. Requiring the mine operator to keep a record of each misfire adds to the burden of paperwork and provides no reasonable assurance that keeping such records will provide the means to reduce the incidents of misfires that may occur. The Agency considers that the manner in which this information is kept is an appropriate matter for mine management that need not be regulated.

Section 75.1328 Damaged or deteriorated expolosives and detonators.

This standard sets forth new requirements for handling and disposing of damaged or deteriorated explosives or detonators. Such exposives and detonators are required by paragraph (a) to be placed in separate containers of nonconductive and nonsparking material and removed from the mine or placed in a magazine for later removal. Several commenters recommended that damaged or deteriorated explosives and detonators be placed in separate containers constructed of nonsparking materials rather than being placed in separate containers with absorbent material as specified in the proposal. Commenters stated that absorbent material could cause an increased hazard if the wrong type of absorbent material, such as coal dust, is used. The use of a container constructed of nonsparking material effectively minimizes the possibility of inadvertent detonation.

The same commenters recommended removal of damaged explosives and detonators at the end of the shift to prevent exposing miners to unnecesary hazards. This suggestion was not adopted because paragraph (c) of this standard requires deteriorated explosives and detonators to be handled and disposed in accordance with the instructions of the manufacturer.

Paragraph (b) requires damaged detonators to be shunted, if practicable, before either being removed from the mine or placed in a magazine. One commenter recommended that damaged or deteriorated detonators be protected from stray current. The final rule addresses this provision by means of shunting the detonators, when practicable.

Paragraph (c) requires damaged or deteriorated explosives or detonators to be handled and disposed of in accordance with the instructions of the manufacturer and is from the preproposal draft. Commenters

requested inclusion of this provision in the final rule, although it was not in the proposed rule. Because of the variety of explosive formulations and detonator types and characteristics, the instructions provided by manufacturers are relied upon by the mining industry as the authoritative source of information when disposing of damaged or deteriorated explosives. Other commenters recommended that damaged expolsives and detonators be disposed of only on the surface. However, the place and method of disposal is addressed in the manufacturer's specific instructions.

Derivation Table

The following derivation table lists the section number of each standard in the final rule and the section number of the existing standard from which it is derived.

New Section	Old Section
75.1300	75.2 and Part 15.2.
75.1301	Part 15 (Article IV).
75.1310	75.1300, 75.1303 and Part 15.19(d).
75.1310(d)	New.
75.1311	75.1301, 75.1304, 75.1305 and 75.1403-7(i).
75.1311(b)(2)	New.
75.1312	75.1301, 75.1306, 75.1307 and Part 15.19(b).
75.1312 (e), (f) and (g)	New.
75.1313 (a) and (c)	New.
75.1313(b)	75.1301, 75.1304, 75.1306 and 75.1307.
75.1314	New.
75.1315	75.1300, 75.1302 and Part 15 (Article IV).
75.1315(d), (e) and (f)	New.
75.1316	75.1307 and Part 15 (Article IV).
75.1316(d)	New.
75.1317	New.
75.1318 (a), (c), (d) and (e).	New.
75.1318 (b), (f), (g)	Part 15 (Article IV).
75.1319	Part 15 (Article IV).
75.1320(a)	75.1303.
75.1320 (b), (c), (d) and (e).	New.
75.1321	75.1303-1.
75.1322(a)	75.1303 and Part 15 (Article IV).
75.1322 (c), (d) and (e)	Part 15 (Article IV).
75.1322 (b), (f), (g) and (h).	New.
75.1323 (a), (b), (c), (d) and (e).	Part 15 (Article IV).
75.1323 (f), (g), (h), (i) and (j).	New.
75.1324	75.320 and 75.1302.
75.1325	Part 15 (Article IV).
75.1325(b)	New.
75.1326	75.1308 and Part 15 (Article IV).
75.1327 (a) and (b)(2)	Part 15 (Article IV).
75.1327(b)(1)	New.
75.1328	New.

Distribution Table

The following distribution table lists the section number of each existing standards in Subpart N and Part 15 and the section number of the final rule that contain revised provisions derived from the corresponding existing section.

Old Section	New Section
75.1300	75.1310 and 75.1315.
75.1301	75.1311, 75.1312 and 75.1313.
75.1302 (a) and (b)	75.1315.
75.1302(c)	75.1324.
75.1303	75.1310, 75.1320(a) and 75.1322.
75.1303-1	75.1321.
75.1304	75.1311 and 75.1313.
75.1305	75.1311.
75.1306	75.1312 and 75.1313.
75.1307	75.1312, 75.1313 and 75.1316(a).
75.1308	75.1326.
Part 15	75.1301, 75.1310, 75.1312, 75.1315 75.1316, 75.1318, 75.1319, 75.1322, 75.1323, 75.1325, 75.1326 and 75.1327.

III. Drafting Information

The principal persons responsible for preparing this final rule are: Edward C. Connor and A. Keith Watson, Coal Mine Safety and Health, MSHA; Harry C. Verakis, Technical Support, MSHA; Richard J. Mainiero, Bureau of Mines; Helen B. Caraway, Office of Standards, Regulations and Variance, MSHA; and Linda Fort, Office of the Solicitor, Department of Labor.

IV. Executive Order 12291 and Regulatory Flexibility Act

In accordance with Executive Order 12291, MSHA has prepared an analysis to identify potential costs and benefits associated with the final changes to its explosives and blasting standards for underground coal mines. The Agency has incorporated this analysis into the Regulatory Flexibility Analysis required by the Regulatory Flexibility Act. In this analysis, summarized below, MSHA has determined that the final rule would not result in major cost increases nor have an effect of $100 million or more on the economy. Therefore, the rule is not within the criteria for a major rule and a Regulatory Impact Analysis is not required.

The Regulatory Flexibility Act requires that agencies evaluate and include, wherever possible, compliance alternatives that minimize any adverse impact on small business when developing regulatory proposals. The final rule clarifies compliance responsibilities and adopts performance-oriented standards which will benefit small mining operations.

In the following summary of the Initial Regulatory Flexibility Analysis, MSHA has compared the costs and benefits associated with the final requirements with the costs of the existing requirements. A copy of the full analysis is available upon request.

MSHA estimates the annual cost for compliance with the existing requirements to be $2.5 million compared to $2.9 million for the final rule. The final regulations effect approximately 1700 underground mining operations. MSHA estimates about 975 of these mines are small businesses. The impact on small mines under existing requirements is $1.5 million compared to $1.8 million for the final rule representing a 19 percent increase. For purposes of the Regulatory Flexibility Act, MSHA has defined small business entities as mines with fewer than 20 employees.

In developing cost estimates, MSHA has taken into consideration industry-wide practices. Compliance costs are related to labor, supplies, and equipment purchase and maintenance. In calculating the costs of the existing standards and the final rule, the Agency projected capital expenditures and recurring costs.

In the final rule, MSHA has reorganized, updated, and clarified existing provisions and deleted duplicative provisions. MSHA believes that clarification will foster a better understanding of safe blasting practices and that the new final requirements, especially those that address the use of sheathed explosive units, will afford greater protection for the miners.

The primary benefit of the final rule is the enhanced protection that the standards will provide to miners who are exposed to the hazards related to the use of explosives.

V. Paperwork Reduction Act of 1980

The final rule contains two collection of information provisions subject to the Paperwork Reduction Act of 1980 (Pub. L. 96-511). The information collection requirements in existing Part 15 and § 75.1303-1, concerning certification of shot firer qualification and permits for the use of nonpermissible blasting units and to fire more than 20 boreholes, are retained in final §§ 75.1301 and 75.1321.

In accordance with section 3504(h) of the Paperwork Reduction Act of 1980 (Title 44 U.S.C. Chapter 35), the collection of information requirements contained in §§ 75.1301 and 75.1321 of the final rule have been approved by

OMB under control numbers 1219–0106 and 1219–0025.

List of Subjects in 30 CFR Part 75

Mine safety and health, Mandatory safety standards, Underground coal mines, Explosives and blasting.

Date: November 9, 1988.

David C. O'Neal,

Deputy Assistant Secretary for Mine Safety and Health.

Accordingly, pursuant to 30 U.S.C. 811 Part 75 Subchapter N, Chapter I, Title 30 of the Code of Federal Regulations is amended as set forth below:

PART 75—MANDATORY SAFETY STANDARDS—UNDERGROUND COAL MINES

1. The authority citation for Part 75 continues to read as follows:

Authority: 30 U.S.C. 811, 957, 961.

2. Paragraph (c)(2) of § 75.2 is removed and paragraph (c)(3) is redesignated as (c)(2).

3. Newly redesignated § 75.2(c)(2) is revised to read as follows:

§ 75.2 Definitions

* * * * *

(c)* * *

(2) The manner of use of equipment means the manner of use prescribed by the Secretary.

* * * * *

Subpart D—Ventilation

§ 75.320 [Removed]

4. Subpart D is amended by removing § 75.320.

Subpart O—Hoisting and Mantrips

§ 75.1403–7 [Amended]

5. Section 75.1403–7 is amended by removing and reserving paragraph (i).

6. Subpart N is revised to read as follows:

Subpart N—Explosives and Blasting

Sec.

75.1300 Definitions.
75.1301 Qualified person.
75.1310 Explosives and blasting equipment.
75.1311 Transporting explosives and detonators.
75.1312 Explosives and detonators in underground magazines.
75.1313 Explosives and detonators outside of magazines.
75.1314 Sheathed explosive units.
75.1315 Boreholes for explosives.
75.1316 Preparation before blasting.
75.1317 Primer cartridges.
75.1318 Loading boreholes.
75.1319 Weight of explosives permitted in boreholes in bituminous and lignite mines.
75.1320 Multiple-shot blasting.
75.1321 Permit for firing more than 20 boreholes and to use nonpermissible blasting units.
75.1322 Stemming boreholes.
75.1323 Blasting circuits.
75.1324 Methane concentration and tests.
75.1325 Firing procedure.
75.1326 Examination after blasting.
75.1327 Misfires.
75.1328 Damaged or deteriorated explosives and detonators.

Subpart N—Explosives and Blasting

§ 75.1300 Definitions.

The following definitions apply in this subpart.

Approval. A document issued by MSHA which states that an explosive or explosive unit has met the requirements of this part and which authorizes an approval marking identifying the explosive or explosive unit as approved as permissible.

Battery starting. The use of unconfined explosives to start the flow of coal down a breast or chute in an anthracite mine.

Blasting off the solid. Blasting the working face without providing a second free face by cutting, shearing or other method before blasting.

Instantaneous detonator. An electric detonator that fires within 6 milliseconds after application of the firing current.

Laminated partition. A partition composed of the following material and minimum nominal dimensions: ½-inch thick plywood, ½-inch thick gypsum wall board, ⅛-inch thick low carbon steel and ¼-inch thick plywood, bonded together in that order.

Opener hole. The first hole or holes fired in a round blasted off the solid to create an additional free face.

Permissible blasting unit. A device that has been approved by MSHA and that is used for firing electric detonators.

Permissible explosive. Any substance, compound or mixture which is approved by MSHA and whose primary purpose is to function by explosion.

Round. A group of boreholes fired or intended to be fired in a continuous sequence with one application of the firing current.

Sheathed explosive unit. A device consisting of an approved or permissible explosive covered by a sheath encased in a sealed covering and designed to be fired outside the confines of a borehole.

Short-delay electric detonator. An electric detonator with a designated delay period of 25 to 1,000 milliseconds.

§ 75.1301 Qualified person.

(a) A qualified person under this subpart is a person who—

(1) Is certified or qualified to use explosives by the State in which the mine is located provided that the State requires a demonstration of ability to safely use permissible explosives as prescribed by this subpart effective January 17, 1989; or

(2) In States that do not certify or qualify persons to use explosives required by this section, has at least 1 year of experience working underground on a coal producing section of a mine where explosives are used and demonstrates to an authorized representative of the Secretary the ability to safely use permissible explosives.

(b) Persons qualified or certified by a State to use permissible explosives in underground coal mines as of May 17, 1989 are considered qualified under this section even though their State program did not contain a demonstration of ability requirement.

§ 75.1310 Explosives and blasting equipment.

(a) Only permissible explosives, approved sheathed explosive units, and permissible blasting units shall be taken or used underground.

(b) Black blasting powder, aluminum-cased detonators, aluminum-alloy-cased detonators, detonators with aluminum leg wires, and safety fuses shall not be taken or used underground.

(c) Explosives shall be fired only with a permissible blasting unit used in a manner consistent with its approval. Blasting units approved by MSHA that have approval labels specifying use with short-delay detonators with delay periods between 25–500 milliseconds are accepted to fire short-delay detonators up to 1,000 milliseconds, instantaneous detonators and long period delay detonators for anthracite mines.

(d) Permissible explosives and sheathed explosive units shall not be used underground when they are below the minimum product firing temperature specified by the approval. Explosives previously approved which do not specify a minimum firing temperature are permissible for use so long as the present approval is maintained.

(e) Electric detonators shall be compatible with the blasting unit and have sufficient strength to initiate the explosives being used.

§ 75.1311 Transporting explosives and detonators.

(a) When explosives and detonators are to be transported underground—

(1) They shall be enclosed in separate, substantially constructed containers made of nonconductive material, with

no metal or other conductive materials exposed inside, except as specified in paragraph (d) of this section; and

(2) Each container of explosives and of detonators shall be indelibly marked with a readily visible warning identifying the contents.

(b) When explosives and detonators are transported by any cars or vehicles—

(1) The cars or vehicles shall be marked with warnings to identify the contents as explosive. The warnings shall be readily visible to miners approaching from any direction and in indelible letters;

(2) Explosives and detonators shall be transported either in separate cars or vehicles, or if in the same cars or vehicles as follows:

(i) Class A and Class C detonators in quantities greater than 1,000 shall be kept in the original containers as shipped from the manufacturer and separated from explosives by a hardwood partition at least 4 inches thick, a laminated partition or equivalent; and

(ii) Class A and Class C detonators in quantities of no more than 1,000 shall be separated from explosives by a hardwood partition at least 4 inches thick, a laminated partition or equivalent.

(3) No persons, other than those necessary to operate the equipment or to accompany the explosives and detonators, shall be transported with explosives and detonators, and

(4) When explosives and detonators are transported using trolley locomotives—

(i) Trips carrying explosives and detonators shall be separated from all other mantrips by at least a 5-minute interval; and

(ii) Cars containing explosives or detonators shall be separated from the locomotives by at least one car that is empty or that contains noncombustible materials.

(c) When explosives and detonators are transported on conveyor belts—

(1) Containers of explosives shall be separated from containers of detonators by at least 50 feet;

(2) At least 6 inches of clearance shall be maintained between the top of any container of explosives or container of detonators and the mine roof or other obstruction;

(3) Except when persons are riding the belt to accompany explosives or detonators, a person shall be at each transfer point between belts and at the unloading location; and

(4) Conveyor belts shall be stopped before explosives or detonators are loaded or unloaded.

(d) When explosives and detonators are transported by hand they shall be carried in separate, nonconductive, closed containers.

§ 75.1312 Explosives and detonators in underground magazines.

(a) The quantity of explosives kept underground shall not be more than is needed for 48 hours of use.

(b) Except as provided in § 75.1313, explosives and detonators taken underground shall be kept in—

(1) Separate, closed magazines at least 5 feet apart; or

(2) The same closed magazine when—

(i) Separated by a hardwood partition at least 4 inches thick; or

(ii) Separated by a laminated partition; or

(iii) Separated by a device that is equivalent.

(c) Only explosives and detonators shall be kept in underground magazines.

(d) Magazines shall be substantially constructed and all interior surfaces shall be made of nonconductive material, with no metal or other conductive material exposed inside.

(e) All magazines shall be—

(1) Located at least 25 feet from roadways and any source of electric current;

(2) Located out of the direct line of the forces from blasting; and

(3) Kept as dry as practicable.

(f) Magazine locations shall be posted with indelibly marked and readily visible warnings indicating the presence of explosives.

(g) Only materials and equipment to be used in blasting shall be stored at magazine locations.

§ 75.1313 Explosives and detonators outside of magazines.

(a) The quantity of explosives outside a magazine for use in a working section or other area where blasting is to be performed shall—

(1) Not exceed 100 pounds; or

(2) Not exceed the amount necessary to blast one round when more than 100 pounds of explosives is required.

(b) Explosives and detonators outside a magazine that are not being transported or prepared for loading boreholes shall be kept in closed separate containers made of nonconductive material with no metal or other conductive material exposed inside and the containers shall be—

(1) At least 15 feet from any source of electric current;

(2) Out of the direct line of the forces from blasting;

(3) In a location to prevent damage by mobile equipment; and

(4) Kept as dry as practicable.

(c) Explosives and detonators not used during the shift shall be returned to a magazine by the end of the shift.

§ 75.1314 Sheathed explosive units.

(a) A separate instantaneous detonator shall be used to fire each sheathed explosive unit.

(b) Sheathed explosive units shall be primed and placed in position for firing only by a qualified person or a person working in the presence of and under the direction of a qualified person. To prime a sheathed explosive unit, the entire detonator shall be inserted into the detonator well of the unit and be held securely in place.

(c) Sheathed explosive units shall not be primed until immediately before the units are placed where they are to be fired. A sheathed explosive unit shall not be primed if it is damaged or deteriorated.

(d) Except in anthracite mines, rock dust shall be applied to the roof, ribs and floor within a 40-foot radius of the location where the sheathed explosive units are to be fired.

(e) No more than three sheathed explosive units shall be fired at one time.

(f) No sheathed explosive unit shall be fired in contact with another sheathed explosive unit.

§ 75.1315 Boreholes for explosives.

(a) All explosives fired underground shall be confined in boreholes except—

(1) Sheathed explosives units and other explosive units approved by MSHA for firing outside the confines of a borehole; and

(2) Shots fired in anthracite mines for battery starting or for blasting coal overhangs. No person shall go inside a battery to start the flow of material.

(b) Each borehole in coal for explosives shall be at least 24 inches from any other borehole and from any free face, unless prohibited by the thickness of the coal seam.

(c) Each borehole in rock for explosives shall be at least 18 inches from any other borehole in rock, at least 24 inches from any other borehole in coal, and at least 18 inches from any free face.

(d) No borehole that has contained explosives shall be used for starting any other hole.

(e) When blasting slab rounds off the solid, opener holes shall not be drilled beyond the rib line.

(f) When coal is cut for blasting, the coal shall be supported if necessary to maintain the stability of the column of explosives in each borehole.

§ 75.1316 Preparation before blasting.

(a) Before priming any explosives—

(1) All mobile electric equipment shall be removed to a distance of at least 50 feet from the working place or other area where blasting is to be performed; and

(2) All stationary electric equipment within 50 feet of the working place or other area where blasting is to be performed shall be deenergized.

(b) Before loading boreholes with explosives, each borehole shall be cleared and its depth and direction determined.

(c) No borehole drilled beyond the depth of cut coal shall be loaded with explosives unless that portion of the borehole deeper than the cut is tamped with noncombustible material.

(d) When two working faces are approaching each other, cutting, drilling and blasting shall be done at only one working face at a time if the two faces are within 25 feet of each other.

§ 75.1317 Primer cartridges.

(a) Primer cartridges shall be primed and loaded only by a qualified person or a person working in the presence of and under the direction of a qualified person.

(b) Primer cartridges shall not be primed until immediately before loading boreholes.

(c) Only a nonsparking punch shall be used when priming explosive cartridges.

(d) Detonators shall be completely within and parallel to the length of the cartridge and shall be secured by half-hitching the leg wires around the cartridge or secured by an equally effective method.

§ 75.1318 Loading boreholes.

(a) Explosives shall be loaded by a qualified person or a person working in the presence of and under the direction of a qualified person.

(b) When boreholes are being loaded, no other work except that necessary to protect persons shall be done in the working place or other area where blasting is to be performed.

(c) When loading boreholes drilled at an angle of 45 degrees or greater from the horizontal in solid rock or loading long holes drilled upward in anthracite mines—

(1) The first cartridge in each borehole shall be the primer cartridge with the end of the cartridge containing the detonator facing the back of the borehole; and

(2) The explosive cartridges shall be loaded in a manner that provides contact between each cartridge in the borehole.

(d) When loading other boreholes—

(1) The primer cartridge shall be the first cartridge loaded in the borehole;

(2) The end of the cartridge in which the detonator is inserted shall face the back of the borehole; and

(3) The primer cartridge and other explosives shall be pushed to the back of the borehole in a continuous column with no cartridge being deliberately crushed or deformed.

(e) An explosive shall not be loaded into a borehole if it is damaged, deteriorated of if the cartridge is incompletely filled.

(f) Explosives of different brands, types or cartridge diameters shall not be loaded in the same borehole.

(g) Only nonconductive, nonsparking tamping poles shall be used for loading and tamping boreholes. The use of nonsparking connecting devices for extendable tamping poles is permitted.

§ 75.1319 Weight of explosives permitted in boreholes in bituminous and lignite mines.

(a) The total weight of explosives loaded in any borehole in bituminous and lignite mines shall not exceed 3 pounds except when blasting solid rock in its natural deposit.

(b) The total weight of explosives loaded in a borehole less than 6 feet deep in bituminous and lignite mines shall be reduced by ½ pound for each foot of borehole less than 6 feet.

§ 75.1320 Multiple-shot blasting.

(a) No more than 20 boreholes shall be fired in a round unless permitted in writing by the District Manager under § 75.1321.

(b) Instantaneous detonators shall not be used in the same circuit with delay detonators in any underground coal mine.

(c) In bituminous and lignite mines, only detonators with delay periods of 1,000 milliseconds or less shall be used.

(d) When blasting in anthracite mines, each borehole in a round shall be initiated in sequence from the opener hole or holes.

(e) Arrangement of detonator delay periods for bituminous and lignite mines shall be as follows:

(1) When blasting cut coal—

(i) The first shot or shots fired in a round shall be initiated in the row nearest the kerf or the row or rows nearest the shear; and

(ii) After the first shot or shots, the interval between the designated delay periods of successive shots shall be at least 50 milliseconds but not more than 100 milliseconds.

(2) When blasting coal off the solid—

(i) Each shot in the round shall be initiated in sequence from the opener hole or holes; and

(ii) After the first shot or shots, the interval between the designated delay periods of successive shots shall be at least 50 milliseconds but not more than 100 milliseconds.

§ 75.1321 Permits for firing more than 20 boreholes and for use of nonpermissible blasting units.

(a) Applications for permits for firing more than 20 boreholes in a round and for the use of nonpermissible blasting units shall be submitted in writing to the District Manager for the district in which the mine is located and shall contain the following information:

(1) The name and address of the mine;

(2) The active workings in the mine affected by the permit and the approximate number of boreholes to be fired;

(3) The period of time during which the permit will apply;

(4) The nature of the development or construction for which they will be used, e.g., overcasts, undercasts, track grading, roof brushing or boom holes;

(5) A plan, proposed by the operator designed to protect miners in the mine from the hazards of methane and other explosive gases during each multiple shot, e.g., changes in the mine ventilation system, provisions for auxiliary ventilation and any other safeguards necessary to minimize such hazards;

(6) A statement of the specific hazards anticipated by the operator in blasting for overcasts, undercasts, track grading, brushing of roof, boom holes or other unusual blasting situations such as coalbeds of abnormal thickness; and

(7) The method to be employed to avoid the dangers anticipated during development or construction which will ensure the protection of life and the prevention of injuries to the miners exposed to such underground blasting.

(b) The District Manager may permit the firing of more than 20 boreholes of permissible explosives in a round where he has determined that it is necessary to reduce the overall hazard to which miners are exposed during underground blasting. He may also permit the use of nonpermissible blasting units if he finds that a permissible blasting unit does not have adequate blasting capacity and that the use of such permissible units will create any of the following development or construction hazards:

(1) Exposure to disturbed roof in an adjacent cavity while scaling and supporting the remaining roof prior to wiring a new series of boreholes;

(2) Exposure to underburden boreholes where prior rounds have removed the burden adjacent to a remaining borehole;

(3) Exposure to an unsupported roof while redrilling large fragmented roof rock following the loss of predrilled boreholes during earlier blasting operations; or

(4) Any other hazard created by the use of permissible blasting units during underground development or construction.

(c) Permits shall be issued on a mine-by-mine basis for periods of time to be specified by the District Manager.

(d) Permits issued under this section shall specify and include as a condition of their use, any safeguards, in addition to those proposed by the operator, which the District Manager issuing such permit has determined will be required to ensure the welfare of the miners employed in the mine at the time of the blasting permitted.

(Approved by the Office of Management and Budget under control number 1219–0025)

§ 75.1322 Stemming boreholes

(a) Only noncombustible material shall be used for stemming boreholes.

(b) Stemming materials other than water stemming bags shall be tamped to fill the entire cross sectional area of the borehole.

(c) Stemming material shall contact the explosive cartridge nearest the collar of the borehole.

(d) Each borehole 4 or more feet deep shall be stemmed for at least 24 inches.

(e) Each borehole less than 4 feet deep shall be stemmed for at least half the depth of the borehole.

(f) When blasting off the solid in bituminous and lignite mines, only pliable clay dummies shall be used for stemming.

(g) The diameter of a water stemming bag shall be within ¼ of an inch of the diameter of the drill bit used to drill the borehole.

(h) Water stemming bags shall be constructed of tear-resistant and flame-resistant material and be capable of withstanding a 3-foot drop when filled without rupturing or developing leaks.

§ 75.1323 Blasting circuits.

(a) Blasting circuits shall be protected from sources of stray electric current.

(b) Detonators made by different manufacturers shall not be combined in the same blasting circuit.

(c) Detonator leg wires shall be shunted until connected into the blasting circuit.

(d) Blasting cables shall be—

(1) Well insulated, copper wire of a diameter not smaller than 18-guage; and

(2) Long enough to permit the round to be fired from a safe location that is around at least one corner from the blasting area.

(e) Blasting cables shall be shunted until immediately before firing, except when testing for circuit continuity.

(f) Wire used between the blasting cable and detonator circuitry shall—

(1) Be undamaged;

(2) Be well insulated;

(3) Have a resistance no greater than 20-guage copper wire; and

(4) Be not more than 30 feet long.

(g) Each wire connection in a blasting circuit shall be—

(1) Properly spliced; and

(2) Separated from other connections in the circuit to prevent accidental contact and arcing.

(h) Uninsulated connections in each blasting circuit shall be kept out of water and shall not contact the coal, roof, ribs, or floor.

(i) When 20 or fewer boreholes are fired in a round the blasting circuit shall be wired in a single series.

(j) Immediately prior to firing, all blasting circuits shall be tested for continuity and resistance using a blasting galvanometer or other instrument specifically designed for testing blasting circuits.

§ 75.1324 Methane concentration and tests.

(a) No shot shall be fired in an area that contains 1.0 volume percent or more of methane.

(b) Immediately before shots are fired, the methane concentration in a working place or any other area where blasting is to be performed, shall be determined by a person qualified to test for methane.

§ 75.1325 Firing procedures.

(a) Shots shall be fired by a qualified person or a person working in the presence of and under the direction of a qualified person.

(b) Only one face in a working place shall be blasted at a time.

(c) Before blasting—

(1) All persons shall leave the blasting area and each immediately adjacent working place where a hazard would be created by the blast, to an area that is around at least one corner from the blasting area;

(2) The qualified person shall ascertain that all persons are a safe distance from the blasting area; and

(3) A warning shall be given and adequate time allowed for persons to respond.

(d) All shots shall be fired promptly, after all persons have been removed to a safe location.

§ 75.1326 Examination after blasting.

(a) After blasting, the blasting area shall not be entered until it is clear of smoke and dust.

(b) Immediately after the blasting area has cleared, a qualified person or a person working in the presence of and under the direction of a qualified person, shall examine the area for misfires, methane and other hazardous conditions.

(c) If a round has partially detonated, the qualified person shall immediately leave the area and no person shall reenter the affected area for at least 5 minutes.

§ 75.1327 Misfires.

(a) When misfires occur, only work by a qualified person to dispose of misfires and other work necessary to protect persons shall be done in the affected area.

(b) When a misfire cannot be disposed—

(1) A qualified person shall post each accessible entrance to the area affected by the hazard of the misfire with a warning at a conspicuous location to prohibit entry; and

(2) The misfire shall be immediately reported to mine management.

§ 75.1328 Damaged or deteriorated explosives and detonators.

(a) Damaged explosives or detonators shall be—

(1) Placed in separate containers constructed of nonconductive and nonsparking materials; and

(2) Removed from the mine or placed in a magazine and removed when the magazine is resupplied.

(b) Damaged detonators shall be shunted, if practicable, either before being removed from the mine or placed in a magazine.

(c) Deteriorated explosives and detonators shall be handled and disposed of in accordance with the instructions of the manufacturer.

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